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Contracting Practice.

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GENERAL CHARGES.

THE items which go to make up the General Charge division of cost may be considered in accordance with the following schedule: The cost will be incurred regardless of any division of items by schedule, and these costs are just as sure as the forces of nature. They may be designated by different titles and proportioned to the estimate in different ways, but they cannot be eliminated any more than we can change the schedule time of the rising and setting of the sun, or the ebb and flow of the tide. They are just as sure and certain a cost as material and labor, and really more destructive to profits, because of the insidious accumulation through gradual and apparently trivial daily expenditures.

For our personal convenience we choose to divide these items, which go to make up the third division of cost under the second or physical divisions of the contracting organization, in this manner, although the same is not proposed as a rule but as a suggestion.

These items must be considered in the estimate, and yet to a very large extent they cannot be determined except as the result of actual experience.

The author well remembers that, when he first began contracting, it was a matter of surprise and bewilderment why jobs, which in cost of material and labor fully realized the estimate, still proved to be losers or nearly so.

It was a considerable time before it was recognized that the many small purchases were, in the end, the destroyers of profits and that it was not safe to pass them by, expecting that the items were of so little consequence that it was not worth the while to consider them in estimating.

Even today employes in the author's own organization do not or cannot understand this point, and consider that the idea is simply a method of taking care of contingencies. This is very far from the truth. These expense items are as true a cost item as material or labor.

Some engineers and contractors advocate an allowance per unit of work, as per yard of excavation, concrete, etc., to take care of these charges. Others add an amount to the estimate, sufficient in their judgment to cover the total item.

The first method is altogether wrong for the following reasons:

First—The addition of any such amount to a price per unit of work is deceptive in its after effects.

Second—Such a method can have no basis except guessing.

Third—The contractor is yet unborn who can differentiate the cost per unit for general charge items on several classes of work and arrive at any intelligent result.

Suppose we imagine an excavation for a pier foundation for a bridge construction requiring excavation, pile driving and concrete. To do this work requires pumping and lots of it, assuming the pier is located out in the stream. Invoices accumulate at the office for coal and oil, and the actual coal and oil is delivered to the job and used as occasion demands. Excavating, pile driving and concreting proceed practically simultaneously. Under these circumstances how can we arrive at any fair cost per unit for fuel and oil? If the attempt is made to distribute the cost in any proportion to the various kinds of work it can only be done by arbitrary methods, which will not bear analysis.

Take another item, viz: Petty Tools. In this classification belong shovels. And what contractor is wise enough or sufficiently in touch with his work to say what proportion of this cost should go to excavation and what to concrete?

Take the Fitting and Repair account. Who can say with any certainty how much of repairs to pumping machinery should

be charged to excavation and how much to pile driving and concrete?

The fact is that all these charges are directly dependent upon the kind of work under construction, and the various jobs will show a greater or less cost along this line in direct relation to the difficulties encountered.

Therefore it follows that the various kinds of work should be separated into definite classifications with respect to the difficulties surrounding construction and each contractor's experience and their percentages ascertained to be added to the estimated cost, to take care of all the items of general charge.

Such classifications have been prepared by the author for his own work, and it has been found that for work of similar character it is really surprising how closely the percentage of cost of these items will compare, even when small and large jobs are in the same list.

The second consideration is the method of application of any such percentages. If the percentage is added to the complete estimated cost of material and labor the results will show wide variation, due to the fluctuation in cost of material. If proportioned over material only, the result will vary still more. The only logical method is to distribute this cost by a percentage on the cost of labor only. This theory is based on the following facts:

First—The labor for the same kinds of work is more really constant than the cost of material.

Second—The contractor must always furnish labor, whereas material may be entirely eliminated; reduced in price by concessions as to transportation, as in railroad jobs with free haul; or, as in cases of work at some distance from railroad facilities, the cost may be greatly increased by delivery cost.

3A—The higher the grade of work the more the cost of labor and the more cost per man hour.

3B—The more difficult the work the greater the cost of labor and the less output per man hour.

3C—The higher the grade or more difficult the work the less output per dollar of expenditure for pay roll.

Granting these conditions, the cost of labor is the measure of efficiency of the work management, and to secure comparable results and proper idea of costs as a basis of efficiency the general charges must be determined by a percentage on labor. This conclusion being always governed by a due consideration for the kind of work.

The more thought given to this conclusion the more it will impress itself on the individual as a truth. Consider any type of construction with which you are familiar and the method will gain in impressiveness with each illustration considered.

Take such a case as heavy, wet excavation. The cost of labor is naturally more than for dry excavation. So also is the cost of all the items going to make up the general charges. For this class of work the increase in general charges will show most in Fuel and Oil, Fittings and Repairs, and Expense. High-grade labor is not employed on this class of work, but suppose we have stonemasons building a piece of masonry which must be carefully cut and fitted. Fuel and Oil and Fittings and Repairs are low in this case, but Expense will be large in proportion to pay roll on account of dressing of tools, etc., and the output per dollar of labor is small. The two illustrations are not comparable and belong in separate classifications, and are mentioned as illustrations of the principles involved.

This method has been applied to 125 jobs, covering ten years of work, and it has been found that really definite comparable results are obtained, where before by other methods the estimates were largely a matter of guess.

In using the percentage method it is always wise to prepare a check estimate by a mental review of the job under consideration and deciding whether the amount determined by percentage, as a result of past experience, seems reasonable.

The schedule or division of General Charges, as suggested, is as follows:

First—Contract Bonds, Maintenance Bonds, etc.

Second—Liability Insurance, comprising Employers' Liability, Public Liability and Workmen's Collective Insurance.

Third—General Expense, items as per list.

Fourth—Petty Tools, as per list.

Fifth—Fuel and Oil, as per list.

Sixth—Fittings and Repairs, as per list.

Seventh—Commissary, where necessary, as per list.

Eighth—Interest.

Ninth—Machinery and Equipment.

Tenth—General Office and Supervision.

In establishing any such schedule as the foregoing it will be recognized that the bookkeeper cannot, day by day, record the general charges in such a way that all jobs, past, present and future, may be compared with reference to the same item, unless a general rule be adopted as to what shall be charged under each heading. Inasmuch as bookkeepers change, but the system must continue, and to preserve a decision once made, it is well to prepare a standard list of the ordinary purchases. Such a list has been prepared for each of the above headings.

In considering Bonds and Insurance, information and rates have been given at

considerable length. The contractor, located in a large community, may not find these data as valuable as the man who is not as closely in touch with a well-informed agent, but for reference and comparison and for purpose of estimating, this information is indispensable. It is, however, advised that wherever possible an agent of the bonding and insurance companies be called upon for verification. Incidentally it should be noted that liability insurance is computed on the pay roll at various rates, according to the hazard of the occupation, thereby adding weight to our contention that the other items of General Charge should also be so adjusted.

Inasmuch as we have insisted that, in estimating, material and labor should be separated, there is no difficulty in the application of this method.

It will be found that for different kinds of work, under various conditions, the proportion of cost of labor with respect to the cost of material will run quite uniform, and if a record is made of these percentages it will assist a great many times in approximate or preliminary estimates.

Now proceeding in detail with reference to each item of General Charges:

BONDS.

The information herewith furnished, with reference to bonds, is according to the manual of fidelity and surety bonds furnished by the courtesy of the Equitable Surety Company, of St. Louis, Mo.

Contract bonds are classified as (a) construction; (b) supply; (c) maintenance.

Construction contracts are those where the work contracted for forms part of, or becomes attached to real property, when the contract in question is completed. When contract for repair or erection of any work classified as construction includes, within the same contract bond, the furnishing of any building material, the entire contract is rated as a construction bond. When the contract is solely for the furnishing of building material and does not include any installation, the contract may be classified as a supply bond.

The rate or premium applicable to construction bonds for usual kinds of contract work is based on a rate of one-half of one per cent. per annum on the contract price. Note this rate is figured on the contract price and not on the amount of the bond; also note that the premium is per annum, and should the work extend over more than one year, allowance must be made for renewal of the same premium. It should also be understood that the premiums are due from the date of the bond, whether actual work begins immediately or not.

Supply contracts may be figured at the rate of one-fourth of one per cent. per annum on the contract price and include the furnishing of supplies, material and machinery of stock design. Machinery, etc., made to special order requires a premium of one-half of one per cent., the same as construction contract. Any labor connected with installation of supply contracts must be figured at the construction contract rates.

Many times it is necessary to furnish a bid or proposal bond. The usual rate for a bond of this character is $5.00 each, and this premium is considered fully earned whether the proposal is successful or not. Should the proposal be successful the premium for this bid bond shall be applied as a part payment on the premium for the contract bond, provided the bond is taken from the same company.

The minimum premiums on construction contract bonds are as follows:

First—Where the bond does not exceed $500.00 and the contract does not exceed $1,000.00; bonds $5.00 each.

Second—Where the bond is over $500.00 or the contract is over $1,000.00; bonds $10.00 each. It will be noted that these minimums require that a contract shall equal $2,000.00 or more before the regular rate of one-half of one per cent. would equal the minimum premium.

There are maintenance bonds of two kinds, viz: Those covering the guarantee of the entire construction work and those where the guarantee only covers a part of the construction work. In the first case the premium rate for maintenance bonds is $1.25 per thousand per annum computed on the contract price, and in the second case $1.25 per thousand per annum computed on the value of the guaranteed work. The premium for the maintenance bond for the entire term of the guarantee is due in advance at the time the construction bond is issued.

It is just as important to the contractor to have a credit line with some well-established bond company as to have a credit with his bank. The standing of any contractor with the bonding company depends on two conditions: (a) Financial standing; (b) moral hazard.

Within reasonable limits a bonding company will extend greater favor to the good moral hazard than to the contractor of better financial standing but with a poor record for fulfilling his obligations.

Many states and municipalities, also the United States government, have special requirements regarding bonds, and it is always well to consult an agent to be sure that the standard rates will apply on any new work. The foregoing rates are standard for all ordinary work.

Inasmuch as the premium on bonds, regardless of the amount of the bond, is computed on the total amount of the contract, which includes material, labor, gen-

eral charge items and profit, we must either compute the bond cost separately from other items of general charge or increase the rates in proportion to the percentage which the pay roll bears to the cost of material and labor. The more accurate method is to complete the estimate, except the bond, and then add the cost of the bond plus the same percentage of profit as used for the general estimate. For all practical purposes, however, sufficiently accurate results are obtained by including the bond cost along with other items of general charge. As our system requires that material and labor be separated in the estimate, we are able to arrive at once at the percentage the pay roll bears to material and labor. By referring then to chart plate IX (to appear in the October number), the proper per cent. to be included in the general charge and added to the pay roll may be ascertained. For instance, if the labor represents 50 per cent. of the cost of material and labor the percentage to be included in the general charge and added to the pay roll is one per cent. If the labor represents 20 per cent., or one-fifth of the cost of material and labor, the per cent. to be included in the general charge and added to the pay roll is 2½ per cent. Naturally if the contract is all labor and therefore all pay roll, therefore representing 100 per cent. of the cost, the rate will be one-half of one per cent. At 10 per cent. labor the per cent. to be added to the pay roll increases to five per cent, but a contract with such a small amount of labor is unusual, and it is recommended that jobs of this character with 10 per cent. or less labor be calculated by the method first suggested. When we have a job with 10 per cent. or less labor we are verging on a supply contract, and it is probable that the cost of the bond can be decreased by a proper division of the work under the headings of construction and supply.

LIABILITY INSURANCE.

Liability insurance is not accident insurance, as some employes seem to understand. Contractors' liability insurance (E. L. policies) is essentially insurance against the contractors' liability for damages because of accidents to any of his employes. It is, in fact, a contract between the contractor and the liability company whereby, in consideration of a certain fee to be paid by the contractor, the liability company agrees to furnish the first or emergency medical aid and to save the contractor harmless from any and all claims as damages up to the limits of the policy. The usual limits of the policy are $5,000 and $10,000, meaning thereby $5,000 for any one individual judgment or $10,000 for any one accident. The latter being the limit for an accident when a number are injured and where the aggregate amount of judgments does not exceed this amount. Almost any limits will be accepted by the liability insurance companies, but the ones named are usual. Any increase of the limits is naturally accompanied by an increase in the rate of premium.

The contractor should consider that his rating or credit with his liability insurance company is as important to a large extent as his credit with his bank or bonding company.

Both the bank and the bonding company gauge the contractor by his financial standing and his general reputation for fulfilling and satisfying his obligations.

The liability insurance company judges the risk in light of its past experience on similar work, but tempers its decision by the standing of the contractor as to his experience, methods and disposition to cooperate with the company to secure reports, records and settlements. A contractor by establishing a good rating may gain the advantage of a close rate, whereas by a poor record he may even go so far as to be refused by one company after another. The interests of the contractor and the liability company are identical and there should be a close co-operation.

The minimum premium for liability insurance is $50, and the only way to avoid an increase in cost, due to this fact when many small contracts are handled, is to secure a general, annual or blanket policy covering all work of any character. Naturally on large work this feature is of no consequence.

The possibility of accidents to the public and the employes of others must be considered, especially where the work is located in a city or town and where others are working on the same contract. To provide for this contingency public liability insurance (P. L. policies) is furnished at a somewhat less rate than for employe insurance.

Workmen's Collective Insurance is now required in some states and is a feature of the insurance cost which will require more consideration in the future, although very infrequently at the present time.

Briefly, this class of insurance may be considered as accident insurance. The rates for the same vary with the class of work. The benefits are:

(a) In the event of death within ninety days a sum equal to, but not exceeding, one year's wages, limited to $1,500.

(b) For the loss of two limbs or two eyes a sum equal to the amount payable under the policy at death.

(c) For the loss of one limb, a sum equal to one-third the amount payable under the policy at death.

(d) For the loss of one eye a sum equal to one-eighth the amount payable under the policy at death.

(e) In the event of temporary total disability a sum equal to, but not exceeding,

one-half the weekly wages for a period not exceeding twenty-six weeks, such sum not to exceed $750 in respect of any one person injured during the policy year.

These benefits are for accidents occuring only during working hours, but by an additional charge of 15 per cent. the policy may be written to cover the whole 24 hours. The brief abstract of standard rates heretofore appended gives a general idea of the cost of employers' liability, public liability and workmen's collective insurance. This table is not intended to cover the entire field of contracting work, but sufficient examples are given to serve as a guide in general contract work.

The rates in this table do not include the hazard due to blasting, unless specifically mentioned. The rates as given are for Illinois, Iowa, Missouri and Nebraska and for all other states by use of the proper differentials.

Many states, by arbitrary legislative enactment, have increased the cost of liability insurance very materially. The intention has been to protect the interests of the workman, but it must not be overlooked that the public must pay the bill in the increased costs of all building operations. The workman is certainly deserving of a certain protection in his line of work, and the economic interest of the community at large justifies a recompense to him or his family for injuries or loss of life, but this result cannot be obtained without a corresponding increase in cost of every building project.

In other words, every contract carries, in addition to the cost of material, labor and supplies, the cost of human effort expressed in loss of time and suffering due to injury and death. This cost is just as true a one and more far-reaching, and should receive its proper recognition; but only by legislative action can this cost be distributed over the entire community and be included in all proposals, which is the essential thing in its effect on the contractor.

The only regret is that such laws are abused by malicious and scheming employes, abetted and assisted by shyster attorneys, to the end of defeating the very purposes of the legislation, thereby making the matter of all claims the subject of distrust and antagonism.

Any prudent or responsible employer of labor cannot afford to be without the protection of liability insurance, for to carry your own risk invites litigation and loss. A minor may have an accident today but can defer suit for seven years; therefore liability insurance should be carried in a well-established company of financial strength. Fire losses cannot exceed the value of your property, but liability for personal injuries cannot be estimated.

TABLE I.

ABSTRACT OF STANDARD LIABILITY INSURANCE RATES—ILLINOIS, IOWA, MISSOURI AND NEBRASKA, SIMILAR TO RATES OF OTHER STATES, BY USE OF DIFFERENTIAL TABLE.

(Courtesy of United States Casualty Company.)

	Employees' Liability	Public Liability	Workmen's Collective
Asphalt layers—street or sidewalk, including yards and shops.	$1.00	$1.00	$2.00
Blasting—add 20 per cent. to E. L., P. L. and Coll. rates, to cover blasting hazards, except in those classifications where blasting is specifically included	...	.....	.....
Bridge building, metal	7.50	2.00	4.00
Bridge building, wood	4.00	1.50	4.00
Building raising, shoring building, removing walls, foundations, columns and piers and rebuilding same	7.50	3.00	4.00
Building movers	5.00	3.00	4.00
Caisson work for foundations of subaqueous operations, with or without blasting, including work under air pressure	10.00	.50	4.00
Canal excavating, not irrigation ditch digging	5.00	1.00	4.00
Carpenters, construction away from shop, not bridge building nor grain elevator construction work	2.25	.75	2.50
Carpenters, grain elevator erection	4.00	.75	2.50
Cellar excavation, no caisson or subaqueous work, including digging holes and filling them with concrete for foundations for buildings	3.50	1.00	2.50
Chimney work, concrete, stone or brick construction, not structural iron or steel	7.50	1.50	2.75
Clay digging, no canal, sewer or cellar excavation or mining	2.25	.50	2.50

Cleaning and renovating stone fronts of buildings, no construction work	3.50	1.50	2.00
Concrete work:			
(a) Bridge abutments not more than 20 feet in height from the base, including making, setting up and taking down of frames and false work	3.00	1.00	2.00
(b) Bridge abutments over 20 feet in height from the base, including making, setting up and taking down of frames and false work	4.00	1.50	2.50
(c) Bridge or building foundations except caisson work	3.00	1.00	2.00
(d) Bridges, including making, setting up and taking down of frames and false work, except caisson work	5.00	1.50	2.50
(e) Buildings, not grain elevators, including making, setting up and taking down of frames and false work	4.00	1.50	2.50
(f) Floors or pavements not self-bearing	1.25	1.00	2.00
(g) Grain elevators, including making, setting up and taking down of frames and false work	5.00	1.00	2.50
(h) Sidewalk laying, including shop and yard work	1.00	1.00	2.00
(i) Unit-system construction of concrete columns, beams, roofs, walls and floors in sections, including subsequent erection of same	7.50	3.00	4.00
Masonry work	2.50	.50	2.00
Carpentry work	1.75	.50	2.00
Concrete work	3.00	.50	2.00
Ditch digging, irrigation or drainage only, no sewer or canal building	1.50	.25	1.50
Dredging by floating dredges	2.25	.50	2.50
Fences, wood, stone, metal or concrete, not over 6 feet high, construction of	1.50	.50	1.25
Galvanized iron and sheet iron workers, erecting and repairing	3.00	1.00	4.00
Gas works, laying of mains and connections; no tunneling. Employers' liability rate excludes gas explosion ,inhalation or asphyxiation	3.00	1.50	2.50
Grade crossing work, involving all work incidental thereto, excluding iron and steel erection work or the laying of new sewers and excluding accident to railway passengers or by any trains except work trains	4.00	1.00	2.50
Grain elevators, concrete, including making, setting up and taking down of frames and false work	5.00	1.00	2.50
Iron men, erecting steel and iron frame structures, no bridge building	7.50	3.00	4.00
Jobbing work on private residences not exceeding three stories and basement in height, and on private stables and garages	2.00	.50	2.00
Jobbing work on buildings other than private residences, excluding remodeling and new construction work	2.75	.75	2.50
Marble and stone setters, inside construction only, including decoration in place	1.00	.25	2.50
Marble and stone setters outside of buildings, away from shop	3.50	1.00	2.50
Masonry work, not otherwise classified	3.50	1.00	2.50
Mosaic work, floors only within buildings	.75	.25	1.00
Paperhangers	1.00	.25	2.00
Parquet floor laying	.75	.25	1.00
Pile drivers, including timber wharf building thereon, if any	4.00	.75	3.00
Pile driving for building foundations	4.00	1.50	3.00
Plasterers	1.00	.25	2.00
Plumbers, shop and outside work, no division of pay roll allowed	1.00	.25	1.50
Road or street making	1.50	1.00	2.50
Roofers, gravel and composition only	2.00	1.00	2.00
Roofers, all other kinds	3.00	1.00	2.75
Sand and gravel diggers, no canal, sewer or cellar excavation or grading	2.25	.50	2.50
Sand excavation by means of suction dredges, including loading and unloading at docks, wharves and elsewhere	2.25	.50	2.00
Sewer building, no limit of depth, with or without blasting	7.50	3.00	3.00
Sewer building, maximum depth of excavation 12 feet at any point, with or without blasting	6.00	3.00	3.00

Sewer building, maximum depth of excavation 7 feet at any point, with or without blasting	4.00	3.00	2.50
Steam, electric street or interurban railway construction, earth work only, no explosives and no tunneling	2.25	(a)	2.50
Telegraph or telephone, construction exclusively	3.00	2.00	2.50
Trestle building, wood	4.00	1.00	2.50
Water towers and standpipes, erection of	7.50	1.50	4.00
Water works, construction of pumping station and the making of dams, reservoirs, excluding erection of water towers and standpipes	3.00	.50	4.00
Water works, laying of mains and connections	3.00	1.50	2.50

The Ohio State Experimental Road.

Editorial Correspondence.

THE State of Ohio has been exceptionally progressive in the matter of investigating new and improved methods of road construction, as well as in constructing by means of the "state aid" plan. Such roads are conceded to be equal to any to be found in the United States. Intelligent, honest effort to ascertain the best forms of construction has characterized the state highway department for a number of years.

In accordance with this principle of investigation it was decided in 1909 to construct an experimental road, upon which were to be laid sections of the various kinds of preparations for preventing dust and binding sections of macadam roads. This work was undertaken through the efforts of James C. Wonders, at that time highway commissioner, and an appropriation was made by the legislature to carry on the work. A section of old macadam road was chosen for the experiment.

In preparing for the work, letters were addressed to the different firms advertising road-building materials, and they were advised of the intention to build this experimental road and of its scope and purpose, and the hope was expressed that all manufacturers would show their confidence in their product by participating in the work. With few exceptions the firms addressed complied with the request and applied their materials on the road. The highway department paid for all labor and materials required in the work, but stipulated that each firm should furnish an expert to superintend its particular section, in order that the work should be constructed exactly according to the manufacturer's ideas. In addition to the above-mentioned work, a few sections were constructed using Portland cement as a binder.

The surface of the road was carefully leveled, and it will be possible to ascertain the amount of wear by releveling at various times.

In 1910 an official inspection of the road was made and photographs were taken to show the progress of wear on the different sections. Since that time no inspections have been made by the highway department, though D. W. Seitz, who has been connected with the experimental work since its start, states that an inspection will be made this fall and at succeeding intervals until the results are fully determined.

At the present time the road shows a marked differentiation between the classes of treatments used, though the distinction between the different kinds of the same class of materials is not evident. It is possible at this time to state that certain sections are showing evidences of deterioration and that others are "holding up" to a degree which indicates that it will be two or three years before they can be divided so as to say which is the best.

There are seventeen sections in this experimental road, each section being of sufficient length to give a fair trial. In the description and comment that follow, the sections are taken up in the order in which they occur, the first three being north of a little village, the fourth and fifth within it, and the other twelve being south and in the open country. A nine-ton road roller which passed during the inspection made notable depressions in some of the sections.

EXPERIMENT NO. 1—GLUTRIN.

This material was applied on a well-constructed, two-course macadam road that had been thoroughly rolled and bonded. Glutrin is prepared from materials produced during the manufacture of cellulose. It is described by the manufacturers as a "calcium-magnesium-ligno-sulfonate, and at the specific gravity of 1.26

SECTION I. GLUTRIN.
Ohio State Experimental Road.

at which it is sold, contains probably about 18.00 per cent. of glucosides." It is a viscous liquid, soluble in water, and in addition to its binding qalities, it is said to form a chemical action upon the road material that increases the flow of the binder, which results from the action of water upon the road metal.

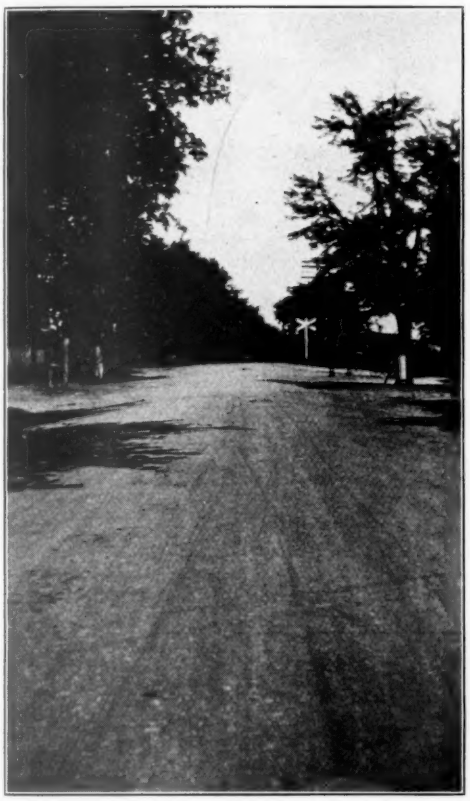
The surface of the macadam was sprinkled with water, and while it was still damp, glutrin was applied by sprinkling with an ordinary road sprinkler. Two applications were made, a day elapsing between the first and second applications. The road was ready for travel in four hours after each application.

Except for a somewhat dusty condition the road is compact and solid and has much the appearance of water-bound macadam, though it is brownish in appearance. The application of the glutrin each year would no doubt alleviate the one objectionable feature of dust. Photograph 1 shows this section.

EXPERIMENT NO 2—STANDARD MACADAM ASPHALT BINDER.

The section of road on which this treatment was applied was first prepared in the usual manner of treatment for the lower course of a water-bound macadam road. Crushed limestone, ranging in size from three inches to one and one-half inches, was then spread to a depth of about three inches. This course was then rolled with a ten-ton roller until it presented a fairly smooth and uniform surface. The asphaltic binder, which had been heated in a small tank at the side of the road, was then applied by means of hand sprinkling cans. About one and one-half gallons of the binder was used for each square yard of surface treated. Screenings varying in size from one-half to three-fourths of an inch were then spread upon the road the road and the roller again brought into use. Additional screenings were added where the binder appeared on the surface, and this work of rolling and adding screenings continued until no more binder appeared on the surface. On a portion of this section a second coat of the binder, consisting of from one-fourth to one-half of a gallon per square yard was applied, followed by another coat of screenings and more rolling.

SECTION II STANDARD ASPHALT BINDER.
Ohio State Experimental Road.



SECTION III. PIONEER ASPHALT BINDER.
Ohio State Experimental Road.

EXPERIMENT NO 3—PIONEER ASPHALT CEMENT.

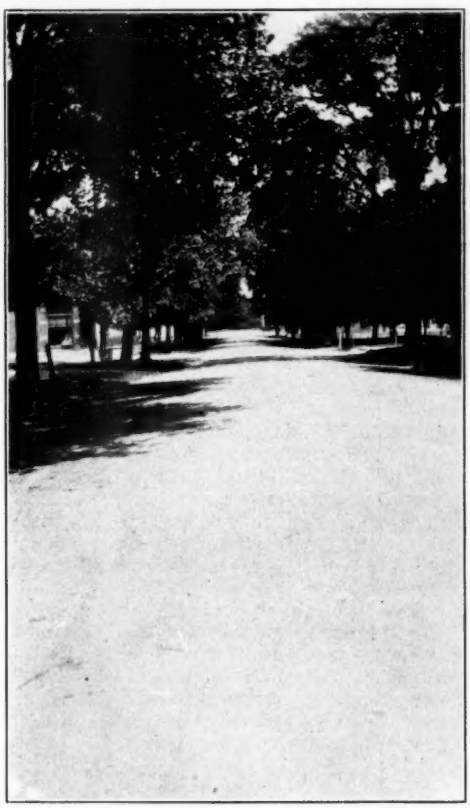
The material used as a binder in this experiment is refined from rock asphalt mined in Utah. In the construction the construction the foundation course was finished as a water-bound macadam road, thoroughly rolled and bonded. The second layer was composed of stone ranging in size from one and one-half to two and one-half inches. This was rolled to a finished depth of about two inches, no water being used. One-half to three-fourths inch screenings were broomed into the surface in a quantity sufficient to reduce the voids about 50 per cent. The asphaltic cement was then poured at a temperature between 390 deg. and 410 deg. F., until all of the stone was thoroughly coated. When the coating had cooled, a thin dressing of screenings was sprinkled over the surface. These screenings were sprinkled but a short distance ahead of the roller, which followed immediately after the screenings were placed. The screenings were sprinkled at first in a thin layer, and as the rolling proceeded more screenings were added, until the coating had absorbed all the screenings which it was possible to absorb. The quantity of the binder used was one and one-fourth gallons per square yard.

The surface is smooth, dustless and in excellent condition with no excess of binder. Photograph 3 indicates this condition.

Asphalt has been forced to the surface to a degree that it has flowed to the side of the road. The temperature at the time of inspection was only about 85 degrees and yet the imprint of the horses hoofs was plainly visible at points on the surface where the asphalt had exuded to a great extent. Excepting for these points the surface is hard and dustless, Photograph 2 shows this section.

EXPERIMENT NO. 4—TARVIA "X."

In the preparation of Tarvia X, ordinary coal tar is heated to drive off the water and ammonia. The road was prepared for this treatment in a manner similar to section No. 3, except that the stones in the top course were from 1½



SECTION IV. TARVIA "X" BINDER.
Ohio State Experimental Road.

SECTION V. TARVIA "B" SURFACE TREATMENT
Ohio State Experimental Road.

to 3 inches in size. No screenings were used. When this course was thoroughly dry, the refined tar, under pressure, at a temperature of from 250 deg. to 300 deg. F., was spread over the surface by means of a hose attached to a tank wagon. The tank was hauled by a steam roller to avoid the displacement of the stone that would be caused by horses' feet. By the use of the tank wagon the tar was kept heated and under pressure, and this method of applying the tar greatly facilitated the work. The time required for one pouring over the entire section was about one-half hour.

This section shows evidences of dust, due, doubtless, to the fact that a number of cross-streets in the village contributed a portion of their surface. The larger stones are in places exposed and worn, but were held firmly in place. Photograph 4 shows this section.

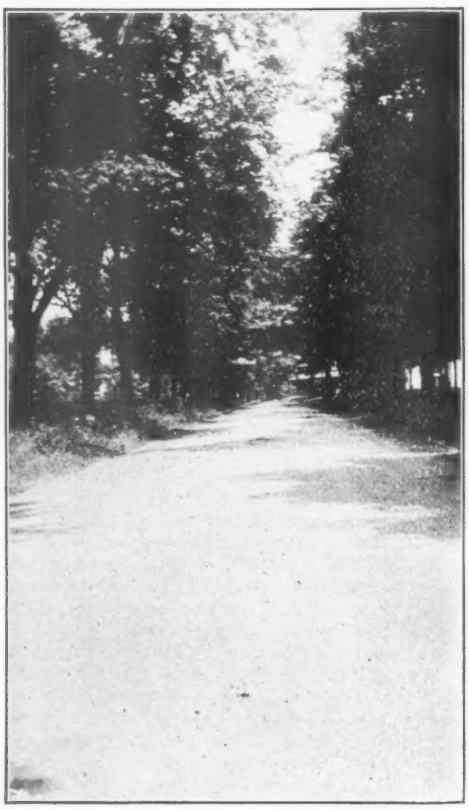
EXPERIMENT 5—TARVIA "B."

This material is a tar preparation that may be applied without heating. In this instance it was placed on a macadam road that had been filled and rolled, but had not been watered, and had been under travel for about two weeks. In making the application, all of the dust and dirt was carefully swept to the sides of the macadam, and on the clean surface the binding material, which had been heated for this work, was applied by means of the same tank wagon that was used for Tarvia "X." Two-thirds of a gallon was used per square yard. As soon as the Tarvia had been applied the dust that had been removed from the road was swept back over this surface.

This section is in excellent condition—superior, in fact, to the section just mentioned. It is hard, perfectly smooth and dustless, as is shown in Photograph 5.

EXPERIMENT NO. 6—LIQUID ASPHALT.

The material used in this section is the Indian Refining Company's heavy asphalt binder, said to contain 90 per cent. asphalt. It was shipped in barrels and was heated for use on the road in a large heating tank. The barrels were rolled on skids to the top of the heating tank, and when in place one head of the barrel was knocked in and the material allowed



SECTION VI. LIQUID ASPHALT BINDER.
Ohio State Experimental Road.

SECTION VII. UGITE BINDER.
Ohio State Experimental Road.

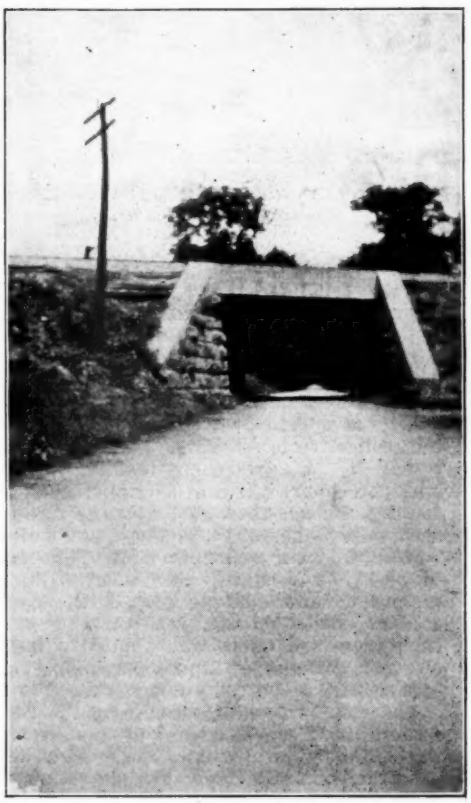
to flow out of the barrel thus opened. Notwithstanding the fact that the weather was very warm while this work was being done, the material was so heavy that it flowed very slowly, and several minutes were required to empty a barrel in this manner. The material was heated to a temperature of about 200 deg. F. and applied to the road under conditions similar to those used for the "Pioneer asphalt," described above.

The larger stones are exposed in this section, but there are no signs of loosening or raveling. The surface is dustless, hard and smooth. Photograph 6 shows this condition.

EXPERIMENT 7—UGITE.

The material used in this treatment is said by the manufacturers to be a true tar, made by treating water gas tar in such a manner that the hydro-carbon compounds of the paraffins in the water gas undergo a chemical change, resulting in the production of a true tar, without producing free carbon, which is commonly found in the coal gas tars; consequently, a material that does not have the deep black color of the ordinary tar. The treatment was applied in two different ways, as follows:

At the beginning of the section, extending south for a distance of 273 feet, after rolling in sufficient ¾-inch stone in the top course to bind it well, 2.05 gallons of the tar were poured on the road, at a temperature of 240 deg. The maximum air temperature during this work was 87 deg., the minimum 75 deg. and the mean 81 deg. F. The tar was heated in a small heating tank placed at the side of the road, and the average rate of application on this part of the section was about 1,200 gallons per day. After pouring the tar on the road a small quantity of ¾-inch stone was then applied, just sufficient to keep the roller from the tar compound, and the surface was well rolled. Stone chips about ½ inch in size were then spread on and well rolled in. A light coating of ¼ inch screenings and dust was put on, to protect the road surface until the compound had a chance to set up. This was rolled until firm. On the remainder of the section, 127 feet in length,



SECTION VIII. FAIRFIELD ASPHALTIC CEMENT
Ohio State Experimental Road.

SECTION IX. ASPHALTOILENE BINDER.
Ohio State Experimental Road.

the compound was applied in two coats. On the top course of stone, which had been filled previously with ¾-inch stone, well rolled in, 1.67 gallons per square yard was poured, at a temperature of 250 deg. F. This was applied at the rate of 1,000 gallons per day. Sufficient ¾-inch stone was spread over the surface to keep the roller from sticking and was well rolled in. A surface coating of .44 gallons per square yard, at a temperature of 280 deg. F., was then put on at the rate of 3,000 gallons per day. One-half inch chips were put on and well rolled in. This was followed by a light coating of ¾-inch screenings and dust, to protect the road surface while setting up. On this section, therefore, there was applied a total of 2.11 gallons of the compound per square yard.

The weather conditions during the construction of the second part of this section were slightly unfavorable, due to a shower at night, which delayed the completion of the rolling of the section.

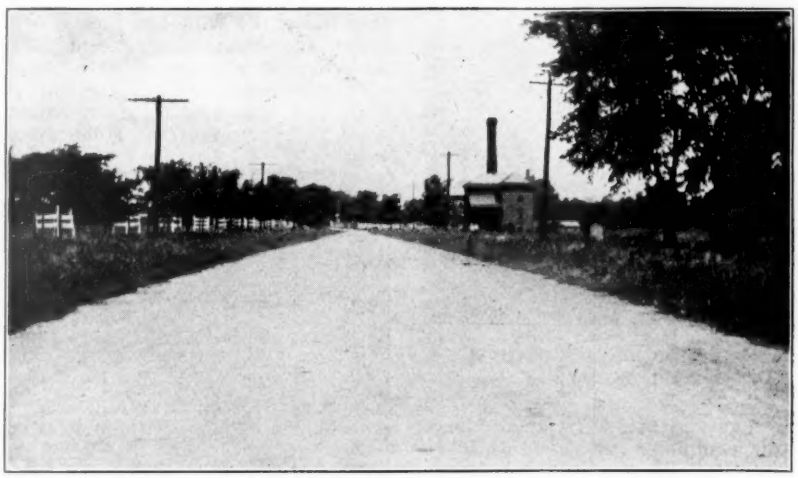
This section seems to be in the same condition throughout, no difference being evident, due to the two methods of construction. At one point on the road, where the seepage water from an overhead railroad crossing had dripped on the road surface, the binding material has been entirely removed from about the stones, leaving them entirely exposed. This erosion may be due to the fact that the water has dropped through a distance of about 15 feet, and may not indicate that the binding material is likely to be washed away when ruts and hollows furnish an opportunity for the water to act on the road surface. Photograph 7 shows this section.

EXPERIMENT NO. 8—FAIRFIELD ASPHALTIC CEMENT.

This material, which is described as a refined asphaltic cement, was applied to the top course of a two-course macadam road. This top course consisted of stone from 1½ to 3 inches in size, in a layer 4 inches thick, and it was thoroughly rolled before applying the asphalt, but without any screenings or other filler. The asphalt was heated in a small heating tank at the side of the road, and applied

SECTION X. WADSWORTH MACADAM BINDER
Ohio State Experimental Road.

on the road by the use of buckets. The work was done about the first of August, when the weather was extremely warm. The asphalt had been shipped in barrels, and it was so heavy and viscous that in order to remove it the barrels were cut in halves with axes, and on account of its adhering to the staves it was frequently necessary to throw them into the heating tank to save the material. After the asphalt had been applied, stone chips, varying in size from ½ to ¾ of an inch, were applied to the surface of the road to a depth of about ½ inch. This was then thoroughly rolled, the chips being forced into the voids of the macadam, and also forming a surface over the top which prevented the asphalt sticking to the roller. When this rolling was completed, the road was ready for travel.



SECTION XI. CARBO-VIA BINDER.
Ohio State Experimental Road.

This surface is in splendid condition, and even under the weight of the 9-ton roller mentioned, it did not show marked depressions where the calks on the wheels had pressed. Photograph 8 shows this section.

EXPERIMENT NO. 9—ASPHALTOILENE.

In the manufacturer's description of this material it is stated that it "is made from a heavy natural oil with an asphalt base and not containing paraffin. This natural oil contains so little of the illuminating oils or valuable products that it is not worth refining for their extraction. It is, therefore, never 'cracked' or coked, but contains a high percentage of liquid asphalt with sufficient oil to act as a solvent and vehicle."

This material was applied on a macadam road prepared after the manner of experiment No. 8, excepting that the stone in the top course ranged in size from 1 to 2½ inches. The material was heated in a small heating tank placed at the side of the road and poured on the road with buckets.

After the asphaltoilene had been applied, ½-inch stone screenings and dust, in about equal parts, were spread over the surface of the road to a sufficient thickness to fill the voids and make a smooth and uniform surface, and the road was rolled until it was thoroughly consolidated and the asphaltoilene showed a tendency to stick to the wheels of the roller.

This section showed plainly the marks of the traction engine wheels, and also the prints of horses' hoofs, much after the manner of an asphalt pavement. The surface is smooth and dustless, as will be noted from Photograph 9.

EXPERIMENT NO. 10—WADSWORTH MACADAM.

This material is Kentucky rock asphalt, very finely ground. It was applied on the top course of a macadam road, prepared after the manner of experiment No. 9. About one inch of the asphalt was spread over the surface of the stone and evenly distributed with hand rakes, and then thoroughly rolled with a steam roller, forcing the asphalt into the spaces between the stones. This probably penetrated beneath the surface of the stone for an inch or more. After this had been thoroughly rolled, another layer of about one inch of the asphalt was spread, and this was again rolled thoroughly. This material was applied in warm

SECTION XII. CONCRETE MACADAM.
Ohio State Experimental Road.

weather, but without artificial heat. When first completed the road tracked very readily; horses' feet and the wheels of vehicles marked it in such a manner that it seemed that it would soon be destroyed. After a few weeks of travel, however, the surface began to get firmer, and in a short time became very smooth.

It is said that for some time after the completion of this section, the surface was so soft as to be easily marked by horses' hoofs and buggy wheels. At the present time the surface is excellent. It is as smooth and dustless as an asphalt pavement, and even under the weight of the 9-ton engine it showed very little evidence of depression from the wheel calks, and absolutely no trace of any cutting of the surface. This section is shown in Photograph 10.

EXPERIMENT NO. 11—CARBO-VIA.

This material is a refined coal tar product. It was applied on a macadam road prepared after the manner of experiment No. 9. The material was heated to a temperature of about 300 deg. F., in the same tank that was used for experiment No. 9, and was poured on the road with hand sprinkling cans. In making the first application about 1½ gallons per square yard were poured. Immediately after the pouring the surface was rolled with a steam roller, the wheels of the roller having been oiled with an emulsion of kerosene and water, to prevent the carbo-via from adhering to the roller. After this rolling, a thin layer of stone chips was swept into the voids, and the surface was again rolled. About ½ gallon of carbo-via per square yard was then applied and rolled as before and covered to a depth of about ¾ inch with stone screenings and dust.

This section is hard and comparatively smooth, as is shown in Photograph 11, but it is not entirely free from dust.

EXPERIMENT NO. 12—CONCRETE MACADAM.

The construction of this section was practically the same as that of a water-bound macadam road, except that Portland cement was mixed with the screenings for the binder of the top course, with the expectation of increasing the cementing power of the stone dust. The

SECTION XIII. TAROID BINDER.
Ohio State Experimental Road.

cement was mixed with the dry screenings in the proportion of one part of cement to six parts of screenings. The mixing was done by hand on board platforms placed at the side of the road, the mixture being turned until it was of a uniform color. Upon the lower course of macadam, which had been shaped, rolled and thoroughly bonded, was spread a layer of limestone varying in size from 1½ to 3 inches, to a depth of about 3 inches. After this course had been thoroughly rolled, the above described filler was applied dry, using a spreading motion of the shovel, the rolling being continued during the process of filling until all of the voids were completely filled. Water was then applied and the rolling continued until a wave of grout was produced in front of the roller over the entire surface. This section was closed against travel and the surface was kept damp by repeated sprinklings for several days after the work had been completed.

This section has much the appearance of water-bound macadam; in fact, the addition of the cement seems to have added nothing to the merits of the road. An excess of dust made it necessary to treat the surface with calcium chloride. Photograph 12 shows this section.

EXPERIMENT NO. 13—TAROID.

Taroid is described by the manufacturers as being "a coal tar pitch prepared in liquidized form as a binder." The lower course, or base, for this section was shaped up with rather small size stone, filled and thoroughly rolled. The stone for the top course varied in size from 3½ inches to 1½ inches. This stone was spread to a depth of about 3 inches. The method of treatment was similar to section No. 3. From 1 to 1½ gallons of hot taroid was poured on each square yard of surface. This pouring was done by hand, 4-gallon galvanized pouring cans, equipped with fan-shaped nozzles, being used. After the taroid had partly cooled, the surface was well rolled. Coarse torpedo sand was then spread over the entire surface and the road was again rolled, which completed the treatment.

An excess of tar has resulted in "bleeding," both on the surface and at the sides of the roadway. The surface is not entirely smooth, by reason of the fact that the tar has not been forced to the surface uniformly, but has come out in such a way as to form small ridges or knobs on the surface. Photograph 13 shows this section.

SECTION XIV. PETROLITHIC PAVEMENT.
Ohio State Experimental Road.

EXPERIMENT NO. 14—PETROLITHIC PAVEMENT.

This process of road treatment was introduced by the Petrolithic Pavement Company, of Los Angeles, Cal., who incorporate a heavy asphaltic oil into the road material by means of various tools and devices, some of which are patented by the company. The tamping roller is an important factor in the construction of this type of roadway. It consists of a roller about 3 feet in diameter whose

surface is studded with iron teeth 9 inches in length and having an end area of about 4 square inches. The action of these teeth on the road material is said to approximate that of a flock of sheep, and to produce a tamping, puddling and kneading action which compacts the lower portion first and gradually works the material into so compact a mass that the teeth or feet of the roller will finally ride on the surface without penetrating or indenting the roadway. The old macadam roadway where this section was constructed was first broken up with a rooter pulled by a steam roller and the loosening completed by turning with a common road plow pulled by horses. The loose stone was then

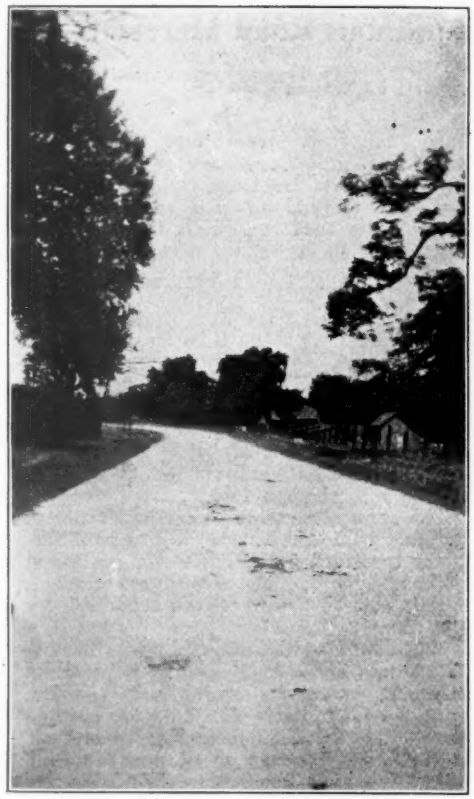
During the summer following the construction of this road, the asphalt was forced to the surface to a degree that it became very objectionable and vehicles chose to travel at the side of the road rather than over the roadway. The highway department caused a course of screened gravel to be rolled into the road in an effort to make the road passable. At the present time, in spite of this treatment, the road is in wretched condition. It is so soft that it shows the imprint of a shoe heel when walking over the surface and the traction engine had cut in so deeply as to make even the imprint of the tires plainly marked. The road surface is spongy and deeply rutted, as will be noted from Photograph 14.

SECTION XV. LIMESTONE CONCRETE.
Ohio State Experimental Road.

smoothed with a heavy "A" harrow. The California liquid asphalt heated to a temperature of 200 deg. Fahrenheit was then applied by means of a Petrolithic Glover road oiler. Three applications of one gallon each per square yard were made. The mass was then mixed by means of the petrolithic road cultivator and tamped and compacted by means of the petrolithic rolling tamper. A road grader was used to crown and shape the roadway. After the work of tamping had been completed a small amount of limestone screening was applied and the surface was smoothed with a steam roller. A fourth application of the asphalt consisting of about one-half gallon per square yard was used, the surface covered with limestone screenings and again rolled.

EXPERIMENT NO. 15—LIMESTONE CONCRETE.

This section was constructed of concrete made of crushed limestone and Portland cement rolled in place with a steam roller. The foundation was prepared by grading and shaping the old macadam road to give it the cross-section desired for the surface of the finished work. It was well rolled before placing the concrete. The concrete was made in the proportion of 1 part cement, 3. parts screenings, ranging in size from ½ inch to dust, and 6 parts limestone from 1 to 3 inches in size. It was machine mixed. Water was used very sparingly on account of the impossibility of rolling wet concrete. It was difficult to secure a concrete mixer for this small amount of work, and the



SECTION XVI. GRAVEL CONCRETE.
Ohio State Experimental Road.

machine that was obtained was not of sufficient capacity to produce the quantity that would secure best results. Owing to the slowness of the work, the roller was obliged to work over such short spaces that in part of the work a wavy surface resulted. If the work had been done more rapidly a much better surface would have been secured. The concrete was uniformly 6 inches deep and had vertical joints across its width at several places.

This pavement, as is shown in Photograph 15, is cracked, and is rapidly wearing at points where the batches of concrete have been joined. It is, of course, hard and dustless.

EXPERIMENT NO. 16—GRAVEL CONCRETE.

This section was constructed as an experiment to determine the utility and economy of gravel concrete for construction of highways in localities where a good quality of bank gravel is found. The concrete used in this section was made from unscreened pit gravel and Portland cement in the proportion of one barrel of cement per cubic yard of concrete. The concrete, which was a wet mixture, was placed on the road 6 inches thick, and the surface was formed by dragging a template over it. This method of construction was used in order to secure a concrete at a low cost that would be uniform in quality from top to bottom, with a surface that would not be slippery. The principal objection to rich concrete for paving has been its slipperiness. This work was made without joints and is in reality a slab 6 inches thick, 16 feet wide and 400 feet long.

This section is in better condition than section 15, as will be noted from Photograph 16. Where expansion cracks have formed there is no evidence of widening. It seems to possess a greater hardness than the preceding section.

EXPERIMENT NO. 17—WATER-BOUND MACADAM.

This section was constructed in accordance with the specifications for water-bound macadam now in use by the State Highway Department. The road is built in two courses, the methods employed on the two courses being identical. The stone ranged in size from 3 inches to 1½ inches. The stone was first rolled dry until there is no longer any waving or creeping movement, and the voids are reduced to a minimum. Dry screenings varying in size from ½ inch to dust were then applied during the finishing process of dry rolling. When the voids were completely filled water was freely applied and the rolling continued until a wave of limestone grout appeared in front of the roller as it passed over the surface. After the surface has been treated in this manner it is allowed to dry out or set before traffic is permitted to pass over it.

This section is excellent macadam and is as hard and smooth as a floor, but it possesses the one common bad feature of macadam: it is very dusty.

Although the experiment has not progressed to a point where the merits of the different treatments may be accurately heavy traffic, carries all classes of of elimination going on which will doubtless indicate two or three of the sections as the best. At the present time it is impossible to draw an accurate conclusion. The experiment is practically ideal in the one particular that a road was chosen which, while it has only a moderately heavy traffic, carries all classes of country road traffic from the loaded farm wagon to the "joy riding" automobilist.

Methods of Distillation of Bituminous Road Materials.

Report of Committee to American Society for Testing Materials.

THE special committee on distillation of road materials of the American Society for Testing Materials made the following report at the recent convention of the society, W. H. Fulweiler being the chairman of the special committee and Logan Waller Page chairman of the general committee on standard tests for road materials:

Our work consisted in distilling three standard samples by four methods. The committee did not feel warranted from the work done so far in recommending the adoption of any of the methods used as a standard method, but felt that the close agreement by the three laboratories with the method using the 250 cc. Engler flask, which was tentatively proposed last year, warranted its serious consideration and further study as a possible standard.

The possibility of securing flasks of specified dimensions in this country, the slight effect of variations in size of flasks on the results, the shortness of time required and the general ease in operation of this method seemed very promising. The precise dimensions of the flask, such as bulb capacity, height of take-off, size of neck, etc., should be studied further.

The question of the thermometer seems exceedingly important, and while the thermometer specified last year has given satisfactory results, further study of this question is felt to be desirable. The committee, however, suggests changing from a nitrogen to a carbon dioxide filled thermometer.

The calibration of the thermometer was not specified before, and the best method at present appears to be to calibrate the thermometer with the immersion and position in which it is to be used. The thermometer is tested, using water-naphthalene and dimethylamine, and by referring to a standard thermometer. For check calibration the ice and steam points alone are necessary, since any change in the calibration seems to apply linearly throughout the scale.

The committee suggests checking after every third analysis for new thermometers until they become seasoned.

With the three samples examined considerable decomposition was apparent above 300 degrees C., and it is felt that no accurate results are possible under such circumstances, and it therefore suggests stopping the distillation at 300 degrees C.

Many crude, and occasionally some refined materials are found to contain water, which seriously affects the accuracy of the first fractions in a distillation. No easy method of dehydration seems possible, so that the committee suggests distilling 500 cc. of the wet material in a copper still provided with a ring burner and a water cooled condenser, and collecting the distillate in a 200 cc. separatory funnel with the tube cutoff close to the stopcock. When all the water has been driven over and the distillate has settled out, the water is drawn off and the oils are returned to the still contents after they have been cooled below 100 degrees C. The distillate should be thoroughly stirred into the residue.

The committee wish to call attention to the fact that some materials have a tendency to stratify on standing, and suggest that all samples be carefully and thoroughly stirred before taking a portion for analysis.

The committee would suggest that the determination of the specific gravity of bitumens is not as simple as it appears, and believes that a standard method should be recommended by the society.

Embodying the above points, the committee suggests the following tentative method for the distillation of bituminous materials suitable for road treatment.

SUGGESTED TENTATIVE METHOD FOR THE DISTILLATION OF BITUMINOUS MATERIALS SUITABLE FOR ROAD TREATMENT.

Sampling: The sample as received should be thoroughly stirred and agitated, warming, if necessary, to insure a complete mixture before the portion for analysis is removed.

Dehydration: If the presence of water is suspected, or known, the material must be dehydrated before distillation. About 500 cc. is placed in a copper still of 800 cc. capacity provided with a distilling head connected with a water cooled condenser. A ring burner is used, starting with a small flame at the top of the still, and gradually lowering it, if necessary, until all the water has been driven off. The distillate is collected in a 200 cc. separatory funnel with the tube cutoff close to the stopcock. When the water is all over and the distillate has settled out, the water is drawn off and the oils returned to the residue in the still. The contents of the still should have cooled to below 100 deg. C. before the oils are returned, and they should be well stirred and mixed with the residue.

Apparatus: The apparatus shall consist of the following standard parts:

1. Flask. The distillation flask shall be a 250 cc. Engler distilling flask, having the following dimensions:

Diam. of bulb	8.0 cm.
Length of neck	15.0 cm.
Diam. of neck	1.7 cm.
Surface of material to lower side of tubulature	11.0 cm.
Length of tubulature	15.0 cm.
Diam. of tubulature	0.9 cm.
Angle of tubulature	75 degrees

A variation of 3 per cent. from the above measurements will be allowed.

2. Thermometer. The thermometer shall be of hardened glass, filled with carbon dioxide under pressure and provided with an expansion chamber at the top; it shall read to 450 deg. C., and shall be graduated in single degrees Centigrade, and shall have the following dimensions:

Diam. of stem	6.75 to 7.25 mm.
Length of thermom.	335 to 350 mm.
Length from 0 deg. to 450 deg. marks	285 to 300 mm.
Length of bulb	20 to 22 mm.
Diam. of bulb	5.25 to 6.50 mm.

It shall rise from 15 deg. to 95 deg. in not less than 3 seconds nor more than 5 seconds when plunged into boiling water.

The thermometer shall be set up as for the distillation test, using water, naphthalene and dimethylamine as distilling liquids. The correctness of the thermometer shall be checked at 0 deg. C. and 100 deg. C. after each third distillation until seasoned.

3. Condenser. The condenser tube shall have the following dimensions:

Length of tube	500 mm.
Width of tube	12 to 15 mm.
Width of adaptor end of tube	20 to 25 mm.

4. Stands. Two iron stands provided, respectively, with one universal clamp for holding the condenser, and one light grip arm with cork-lined clamp for holding the flask.

5. Burner and Shield. Bunsen burner with tin shield 20 cm. long by 9.0 cm. diameter. The shield has a slight hole for observing the flame.

6. Cylinders. The cylinders used in collecting the distillate shall have a capacity of 25 cc., and shall be graduated in tenths of a cubic centimeter.

Setting Up the Apparatus: The apparatus is set up as shown in Table 7, the thermometer being placed so that the top of the bulb is opposite the middle of the tubulature. All connections should be tight.

Method: 100 cubic centimeters of the dehydrated material to be tested is placed in a tared flask and weighed. After adjusting the thermometer, shield, condenser, etc., the distillation is commenced, the rate being so regulated that 1 cc. passes over every minute. The receiver is changed as the mercury column just passes the fractionating point. The following fractions should be reported:

Start of distillation.
Up to 110 deg. C.
110 deg. C. to 170 deg. C.
170 to 235.
235 to 270.
270 to 300.
Residue.

To determine the amount of residue the flask is weighed again when distillation is complete. During the distillation the condenser tube shall be warmed when necessary to prevent the deposition of any sublimate. The percentages of fractions should be reported both by weight and by volume.

W. H. FULWEILER,
Chairman of Special Committee on Distillation.

Respectfully submitted on behalf of the committee.

L. W. PAGE, Chairman.
PREVOST HUBBARD, Secretary.

COMPARISON OF THERMOMETER SPECIFICATIONS.

	Office of Public Roads.	Barrett Mfg. Co.	United Gas Improvement Co.
Filled under pressure	Yes, nitrogen	Yes, nitrogen	Yes, nitrogen
Expansion chamber	Yes, at top	Yes, at top	Yes, at top
Graduated	400 deg. C. in deg.	400 deg. C. in deg.	450 deg. C. in deg.
Accuracy, required	¼ deg. C.	¼ deg. C.	¼ deg. C.
Immersion		3 in.	
Total length	430 mm.	370 mm.	335 mm.—350 mm.
Diameter of stem	7.2—7.4 mm.	7.8 mm.	6.75—7.25 mm.
Scale length	—23 deg. to 400 deg., 363.5 mm.	0 to 400 deg., 267 mm.	0 to 450 deg., 285—300 mm.
Length of bulb	30.2 mm.	11.1 mm.	20—22 mm.
Diameter of bulb	6.7—5.7 mm.	6.35 mm.	5.25—6.50 mm.
Sensibility	15 deg.—90 deg. in from 3 sec.—6 sec.	80 deg. in from 3 sec.—5 sec.	15 deg.—95 deg. in from 3 sec.—5 sec.

Sewage Disposal with Respect to Offensive Odors.

By George W. Fuller, M. Am. Soc. C. E., New York City.

Removal of Suspended Matter and Disposal of Sludge.

TAKING everything into account, it may be said that the treatment that is most suitable and available to-day to secure the requirements of disposal of sludge with minimum opportunity for objectionable odors is that of the two-story tank, in which sedimentation occurs in the upper chamber and the digestion of the sludge in the lower compartment, with no connection between the two for transmitting gases or other products from the lower to the upper. In the opinion of the writer it constitutes the greatest step in advance that has been taken in the field of sewage disposal during the past five yeaers. This opinion is given with full appreciation of the fact that the process is one that requires careful management and that there is a large amount of work to be done by the chemist and bacteriologist in adapting it so as to work to best advantage under a wide range of differing local conditions.

This process, like practically all others, is not a cure-all for various conditions without careful management. There is no reason to believe that sludge digestion by this process does not involve sulphureted hydrogen and all other malodorous products. Available data clearly indicate that these products are formed. The problem is to control them as well as or better than they have been controlled in the several score of plants that have worked so well in the Emscher district in Germany. In some measure the Emscher results have been associated in the minds of some with iron compounds which precipitate sulphureted hydrogen and which may perhaps have much to do with the texture and condition of the sludge, as regards its rate of drying on strainers of coarse sand or gravel. It also may be that the mixing which occurs in the digestion chamber, due to gas ebullition, may be of much benefit, and that this may be controlled under some circumstances to advantage by artificial mixing with aid of water introduced under pressure, as has been done in some instances in the Emscher district.

There is no reason why the artificial application of iron salts should not be availed of in well-managed plants, if needed. With this done, a large share of the difficulties encountered in some plants could be overcome as regards the objectionable odors encountered from time to time.

Filtration Processes.

When a sewage has been well clarified under such conditions that it has been kept as fresh as possible—that is, with bacterial decomposition on an oxidizing and not on a reducing basis—and where the sludge has been taken care of in an inodorous way, it is not a difficult matter to filter the sewage by one of several different methods, so as to secure a non-putrescible effluent of good appearance, without objectionable odors. Reference will be made briefly to these filtration methods, as follows:

Intermittent Sand Filtration.—This method, which has been used generally in New England, is a satisfactory one for small or moderate sized plants, where the filter beds may be economically established. This means usually that their applicability depends much upon finding deposits of porous sand conveniently accessible. When such sand deposits are not readily available, as is true outside of the glacial drift formation, coarse-grained filters are generally more applicable. The intermittent filters will give an excellent effluent, and where the surfaces are not allowed to become clogged there will be no objectionable odors, although there are, of course, noticeable odors immediately at the beds. Objectionable odors are coincident with clogged surfaces, particularly where the filter material is fine and where the sewage stands for some time so that it actually putrefies upon the filter bed. One of the reasons why, in the northern climates, intermittent filters so seldom produce a nuisance as to smell is that they carry their load much more readily during the summer than during the winter months. In other words, rates of filtration which can be availed of during the winter, when decomposition takes place slowly at low temperatures and when it is impossible to clean the filter surfaces for weeks at a time, seldom give trouble in the summer, when frost and snow are absent, but when bacterial decomposition is most active. With fairly porous material and with unsettled sewage, good results should follow the use of this method, where the sewage of not more than 600 people per acre is applied. For short periods unsettled sewage in larger quantities may be applied, particularly if the material is fairly coarse. It is not wise to figure permanently upon such large doses that clogging arises to a degree that makes its removal too fre-

quent and expensive. Where sewage has been clarified or passed through stone filters, rates of filtration much in excess of those above indicated may be safely used, but it is difficult to state just what the limit should be for varying local conditions. The load certainly should not be such as to cause putrefaction to develop, with its attendant bad odors.

Contact Filters.—These filters will operate satisfactorily in beds of a depth of about four feet, when receiving sewage after some clarification at the rate of about 600,000 gallons per acre daily. Where the material is fairly fine it does not seem feasible to increase this rate much with clarified sewage. The reason of it is that during such a large portion of the time the beds have no air in their pores. The rates probably could be increased by keeping the applied sewage fresh and by using coarse stone that drains quickly, and also by commencing drainage operations a short time after the pores of the material are filled. One of the great steps in advance recently in the design of this style of filter is to fill them from below to within a few inches of the surface. Thus the sewage does not appear while it is in a putrescible condition. This method also has the advantage of eliminating surface clogging and the necessity of scraping off deposits of scum which have bad odors under some circumstances. The underfed beds, however, should be provided with a false bottom beneath the filter material, and should be drained at a velocity which will flush out solid matters which appear on the filter floor. This means that this style of filter possesses to a considerable extent the unloading feature of sprinkling filters. Under ordinary circumstances it calls for a final settling basin in which the coarse deposits are removed before the final effluent enters a small stream or is applied to a high-rate sand filter.

Sprinkling Filters.—When the applied sewage is fresh, as is the case at Reading, Pa., where dissolved oxygen is almost never absent in the sewage that reaches the filter plant, this style of filter rarely gives odors that are noticeable 200 feet away. On the other hand, if the applied liquid is in a putrefying condition, the sprinkling of the influent releases the various malodorous products, particularly the sulphur compounds, and at the same time there is a smaller percentage of saturation of atmospheric oxygen in the liquid as it reaches the surface of the filter. Filters of this type, 6 feet deep, will ordinarily dispose satisfactorily of the sewage of some 20,000 to 25,000 people per acre. This is predicated on the conditions being such that the atmospheric oxygen is present at all times and at all places within the pores of the filter bed. The filtering material should not be too fine, as otherwise there is danger at intervals of surface clogging, due either to suspended matter in the sewage or to filamentous vegetable growths, or both. With reference to the size of the material, that most generally preferred is either from 1 to 2 inches in average size or from 1½ to 2½ inches. The use of hypochlorite of lime for destroying vegetable growth and in promoting the self-cleansing of the filter bed as desired, according to Mr. S. S. Chase, of Reading, makes moderately fine material safer than it was generally considered to be a few years ago. Artificial aeration of stone beds such as was studied years ago at Lawrence and Newport has again been studied in Europe, with the conclusion that it is of benefit. It is not believed by the writer that this is correct in principle, unless it provides oxygen at some place where it would otherwise be lacking at times. Ventilators are so inexpensive, however, that exception can scarcely be made to their trial.

STERILIZATION PROCESSES.

Where sewage is discharged into drinking water streams or bodies of water from which shell fish are obtained, it is possible and sometimes advisable to destroy at moderate cost the vast majority of disease producing germs in the sewage by applying strong oxidizing chemicals such as hypochlorite of lime or soda. This treatment scarcely provides absolute sterilization as it is obviously out of the question at moderate cost to destroy by oxidation the thick walled spores or even the vegetative bacterial cells that are encased in particles of suspended matter. It is feasible, however, to destroy more than 99 per cent. of the vegetative cells which respond to ordinary laboratory methods of enumeration.

Several investigators have noted that when sewages or sewage effluents are treated with a sterilizing chemical the liquid will not putrefy for some time. This is explained in a large measure by the death of bacteria which are capable of decomposing the sewage and thus setting up putrefaction after available oxygen is exhausted. Even when such samples are mixed with surface waters of good quality a comparatively long period may elapse before they putrefy. This may be explained in part by an excess of the sterilizing chemical which may destroy the bacteria of the water which is mixed with the treated sewage or sewage effluent. It may also be explained in part by the failure of the diluting water to contain bacteria which readily bring about a reducing fermentation or putrefaction.

It is not to be inferred, however, that

sterilized sewage may be discharged with impunity into small water-courses particularly if there is considerable suspended matter in the treated product. It would be only a question of time before the suspended matter would deposit and form sludge banks in which bacterial putrefaction would become established. It is also probable that sterilized sewages or sewage effluents regardless of the suspended matter would sooner or later putrefy in their flow in water courses by mingling with the surface waters containing bacterial flora that would set up putrefaction.

Reflection upon the comments above made will be of assistance in understanding the practical application of bacterial processes of oxidation and putrefaction in that they show that it is necessary to have time, bacteria and oxygen to bring about an oxidizing fermentation; and, further, that it is necessary to have the right kinds of bacteria, the necessary amount of time and absence of oxygen to bring about putrefaction. Sewage will not putrefy if all three factors are not provided and this also explains why oxidation even of crude sewage will continue for an abnormal period when the oxygen is increased by aeration and thus postpone the time when putrefaction arises.

RESUME.

The purpose of this paper is largely to outline the writer's present understanding of the scientific status of oxidation and reduction as these products occur in sewage treatment. This has been done, partly with a view to promoting appreciation of the subject by those who are not specialists in this field and partly to indicate where more data are desired.

As to the practical art of sewage disposal the methods now available permit much more satisfactory results to be obtained than was the case a few years ago. Those causes, which from time to time in exceptional cases have resulted in unsatisfactory conditions, with objectionable odors now and then noticeable at some distance from the disposal plant, are now quite well understood. Consequently, there should be in the future far less opportunity than at present to cite instances where modern sewage disposal works with good management fail to eliminate nuisances but tend to create them.

What is the Best Street Pavement?

By J. C. Travilla, Street Commissioner, St. Louis, Mo.

IN St. Louis the street commissioner has under his supervision the platting, improving, cleaning, sprinkling and maintenance of the streets, avenues, boulevards and roads.

The highways of the city are generally acquired by dedication. The owners, in subdividing their property into blocks and lots, open up streets and alleys. In the subdivision each owner is desirous of obtaining a maximum number of front feet for his property, without due consideration of the alignment and width of the streets. In most of our cities this method of acquiring highways has brought about a very unsatisfactory condition of affairs. Commissions are being authorized for the replanning of a number of cities, and city officials are endeavoring to secure legislation prohibiting the platting and recording of property without previous approval of the same by some agent of the city. Following the subdivision of property with the growth, expansion and public necessities of a city, highways are eventually converted into improved city streets; therefore, while the mileage of finished streets increases yearly, the extent of the work remaining to be done is not greatly diminished.

Expressing the work of the St. Louis street department in money values there is appropriated annually for cleaning, sprinkling and repairing 930 miles of streets and boulevards $1,318,000. In addition there is paid annually to contractors by property owners $2,500,000 for the improvement of streets, boulevards and alleys. For street and boulevard paving all of the standard materials are used, to-wit: asphalt, bitulithic, creosoted wood block, vitrified brick, granite block and macadam.

I am frequently asked: "What is the best paving material for city streets and boulevards?" This question cannot be readily answered, as the particular material that should be selected depends upon the character of the traffic, street grades, realty values and other elements. Each class has its proper place, but the first cost per square yard determines for the average taxpayer his choice of a paving material. Different kinds of paving material rise and fall in public estimation, due to various causes, the verdict resulting sometimes from inferior workmanship and material and as often from the condition of the pavement under varying degrees of temperature, dryness, cleanli-

ness, noise, traction and the lack of judgment of the taxpayer or highway commissioner in its selection.

The ideal pavement should be elastic, smooth, noiseless and stand up a reasonable or economic length of time under the traffic conditions to which it is subjected. By comparison with other materials, granite block seems to be the only paving material that will last indefinitely. Each class of paving material deserves special mention in a discussion of this kind.

The asphalt and bitulithic pavements consist of mineral matter held together by a bituminous material. The success of either depends upon the character of the bitumen, mineral matter, the grading of the latter, the manipulation of the material at the plant and its proper handling on the street. Satisfactory results may be obtained with both materials if traffic conditions be given due consideration in the choice and specification of materials and method.

These paving materials are especially adapted to residential streets and boulevards, free from street car tracks, and where heavy hauling is not excessive. On narrow streets with car tracks traffic is confined to the space between the outer rail and the curb line, and if not sufficiently distributed, the wagon tires invariably form a groove in the pavement. Paving the space between the street car rails with these materials is not recommended.

Wood block has been recognized as a paving material for many years. Because of insufficient impregnation with the preserving material and therefore lack of waterproofing, the first pavements of this class were not a success. The modern wood block pavement, where the blocks have been impregnated with creosote oil and coal tar, gives every indication of being the best paving material. The waterproofing of the blocks by means of a heavy oil seems more essential than the character of the preservative used. The life of this type of pavement has been a surprise to engineers and taxpayers.

Various kinds of timber are well suited for paving blocks. My experience, however, has been limited to the use of southern long-leaf yellow pine and tamarack, both of which have been equally satisfactory. The amount of oil used per cubic foot has been varied from twelve to twenty pounds.

This pavement is well suited to high-grade residential streets and boulevards and for streets in the retail business districts, where there is much mixed traffic and a demand on the part of the merchants for a noiseless pavement. Its objectionable feature is its smoothness, causing it to become slippery under certain weather conditions. This may be overcome, however, by the use of sand. It has been the practice of the department here to use oiled sand. The oiled sand is applied late in the fall and in the early spring. By the use of oil the sand is held in place on the surface of the pavement—not blown to the curb line. Comparatively speaking, wood block is a high-priced pavement.

Vitrified brick is very largely used for paving. The brick may be readily obtained, are easily laid by unskilled labor and its use offers opportunity for much competition. Its objectionable features are noisiness, chipping of edges, lack of elasticity and, where a stiff grout has been used as a filler, the expense for repairs and maintenance. A grouted brick pavement with very little traffic if laid late in the fall or early spring is apt to disintegrate in spots, due to expansion, if sufficient provision to accommodate this has not been made by use of transverse as well as longitudinal expansion joints. It is our practice to place transverse expansion joints every hundred feet or oftener. The use of brick should be limited to streets having car tracks and on the less important residential streets.

Granite blocks alone meet traffic conditions in the railroad and warehouse districts.

The use of macadam is well adapted to city streets where property values are low and where there is a demand for a temporary paving, pending the construction of sewers, the laying of water mains, etc., and on boulevards and roads carrying light traffic.

Without a firm foundation all of the paving materials named will prove failures. For the hard pavements a base of from five to six inches of Portland cement concrete in the proportion of 1-3½-7 has been found adequate.

The maintenance of a bituminous pavement for a period of five years from the date of its completion usually devolves upon the contractor. This period of time has been fixed by city officials because of their lack of knowledge of the resistance to traffic and temperature changes of bituminous materials.

With standard specifications and laboratory facilities this guarantee will, in time, be reduced to a much shorter period. The guarantee contracts are a source of trouble to the commissioner, since the contractor tends to suit his own convenience in starting repairs. Usually he is inclined to wait until some service corporation cuts are to be repaired in the vicinity of the maintenance work. In my opinion, a city should have proper equipment for every branch of street repairs and maintenance.

Street excavations if not properly regu-

lated are detrimental to the life of the pavement. It is the practice here to have an inspector on the work when the trenches are refilled to see that the earth is properly tamped up to the bottom of the concrete. The trench is then filled with sand to within four inches of the surface of the pavement, vitrified brick being laid in the cut, flush with the pavement. This sand is eventually used when the excavation is ready for concreting.

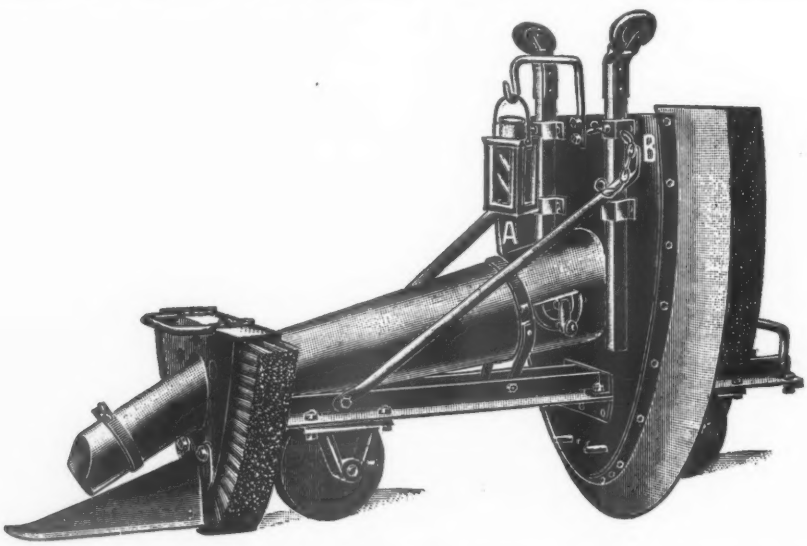
City streets and boulevards would not present a pleasing appearance if they were not regularly cleaned. This division of work not only adds much to the comfort of the people, but acts as an advertisement for the city and its administration. Good results depend largely upon the efficiency of the organization and a sufficient appropriation to properly carry on the work.

The sprinkling of city streets and boulevards with water is difficult to regulate. The number of times a pavement should be sprinkled per day depends upon the season of the year, the character of the pavement and traffic conditions. In St. Louis the work is done under contract and costs from $450 to $500 per mile per annum. At the present time we have more than 500 miles of streets included in this contract, the average cost per annum to the property-holder being about four cents per front foot.

Sewer Scrubber and Scraper.

By Dr. Robert Grimshaw, Dresden, Germany.

THE apparatus here illustrated, and which is in use in several German cities, and was exhibited in the Dresden Hygiene Exposition, is designed to effect a thorough scrubbing and scraping of the sewer walls. It is introduced into the sewer at any convenient shaft, a part of the apparatus being temporarily removed for this purpose. This removal and the subsequent replacement are facilitated by the use of pins and cotters. The oval-edged scraper folds above its main axis; it is furnished with an India-rubber "squeegee" edge, readjustable to the width of the canal after wear, and a profile brush reaching to the short axis of the sewer's cross-section. The pilot of the device is formed by a stiff, coarse profile brush extending about half way up to the short diameter of the sewer oval. A guide wheel on the under side and two guide wheels above, vertically adjustable in height, hold the device square across the sewer and insure that the squeegee packing fits well all around. The scraper dams up the sewage until it has reached a certain height; then a butterfly valve in the dam or cross-wall is opened and the apparatus is automatically set in motion, being driven by the



force of the water behind it. The plow in front stirs up the mud deposit and the dammed-up water from the cross-wall flushes it out.

Tests in Ludwigshafen on the Rhine, on a reach of 620 meters, or 2,034 feet, of sewer, with a cross-section of 70x105 centimeters—27.6x41.4 inches—gave the comparative costs of cleaning by hand and by this apparatus, as follows:

Hand—
3 men 12 days at M. 5.....M. 180
Removing the deposits.....M. 35

Total .....M. 215

Apparatus—
3 men 2 days at M. 5.....M. 30
Removing the deposits.....

Total .....M. 30

This figures up for hand work 34 pfennigs per meter; by the machine, only 4.8 pfennigs, not counting interest, depreciation and upkeep. Reckoning for these 15 per cent. of the original cost, we have only 6 pfennigs as against 34 for the hand system.

In Dortmund, for a sewer 165x195 centimeters—65x77 inches—the following data are given:

	Length		Wages, Mks.	Removal of Deposits	Total Cost	Cost per Meter length
	Meters	Feet				
Hand	355	1165	812	M. 493.50	M. 1305.50	M. 3.67
Hand	127	417	379.40	M. 87.50	M. 466.90	M. 3.67
Mach.	787	2582	575.40	M. 70	M. 645.40	M. 0.82

In this latter test the apparatus had to contend with an uneven sewer bottom, there being places where the level had fallen 30 inches by reason of mining operations.

The apparatus is exhibited by Haase & Co., of Gotha. For an oval sewer 36x54 inches in cross-section the weight is about 330 pounds.

A mark is 24.8 cents in value, or the costs in dollars are practically one-fourth the costs given in marks.

The Pollution of Streams by Manufacturing Waste.*

By William S. Johnson, C. E., New York City

WILLIAM S. JOHNSON, Tech. '89, sanitary and hydraulic engineer of Boston, discussed the growing tendency on the part of the public to resist all pollution of streams, and the measures open to the manufacturers in dealing with this part of the problem. Mr. Johnson said in part:

In the case of streams the public is beginning to demand something more than protection to health. It requires that the stream shall become, as they will if kept clean, the most attractive features of the neighborhood. It is at the same time becoming better understood that it is possible to have clean streams, even in a region devoted to manufacturing, and that the expense of securing this condition is not such as to drive the manufacturer from the district. In fact, this movement for clean streams is so wide-spread that the manufacturer would have difficulty in finding a location where he would feel certain that this demand will not arise, either now or in the near future.

It is certain that this public demand, enforced as it has already been by the legislatures and the courts, and the demand of the manufacturers themselves who require clean water in the manufacturing processes, will result in the necessity of keeping out of many of our streams the most objectionable of the manufacturing wastes, and this has become one of the serious problems to be met by the manufacturer.

The simplest solution of this problem, so far as the manufacturer is concerned, is to make, where possible, a connection with the public sewers, transferring the problem of the disposal of the wastes to the public authorities; but this method of disposal is, in many cases, impossible and its feasibility in other cases questionable.

In this country the tendency is rather to prevent the discharge of any considerable quantity of untreated manufacturing wastes into the sewers and to oblige the manufacturer to construct independent works, or at least to treat the wastes so that they will not cause trouble in the sewers or at the disposal works.

The quantity of liquid wastes produced at a single factory is frequently greater

*From a paper before the Congress of the Massachusetts Institute of Technology.

than the total quantity of domestic sewage flowing in the sewers of the town in which the factory is located, and the character of the wastes may be such that they cannot be purified in connection with the sewage, except at a very great increase in the cost. The cost of the sewers and of sewage disposal is largely assessed upon those benefiting by the sewers and in proportion to the benefits received. If a proper portion of the cost should be assessed on the manufacturers the assessment would be in many cases enormous and enough to make such disposal practically prohibitive.

Some wastes can undoubtedly be discharged into the sewers without causing trouble, depending on the character of the wastes and their volume as compared with the volume of domestic sewage flowing in the sewers. Other wastes can be discharged into the sewers after some simple preliminary treatment without causing trouble; but in perhaps the majority of cases, where wastes cause trouble in the stream, they are likely to cause trouble in the sewerage system, especially if the sewage is purified.

Manufacturing wastes vary very greatly in their composition and generally have quite different characteristics from domestic sewage. In some cases the wastes are very much more readily disposed of by dilution than is domestic sewage, while in other cases the effect of dilution is very much less. No fixed rule can be applied to the amount of manufacturing wastes of any given kind which can be discharged into a stream of given volume, for the seriousness of the pollution depends on the use to which the water is put even more in the case of manufacturing wastes than in the case of domestic sewage.

The Combined Water Works, Electric Light and Ice Plant at Loveland, Ohio.

By Frank C. Perkins, Buffalo, N. Y.

THE many advantages to be gained by combining in a single installation an electric light plant, water works and ice-making equipment are clearly shown by the accompanying illustrations and the following data of such a combination at Loveland, a town of several thousand inhabitants near Cincinnati, Ohio. This town is located on the Little Miami river, and the three systems of ice-making, water works and electric light and power distribution are operated by a single office force of the Loveland Citizens' Electric Company.

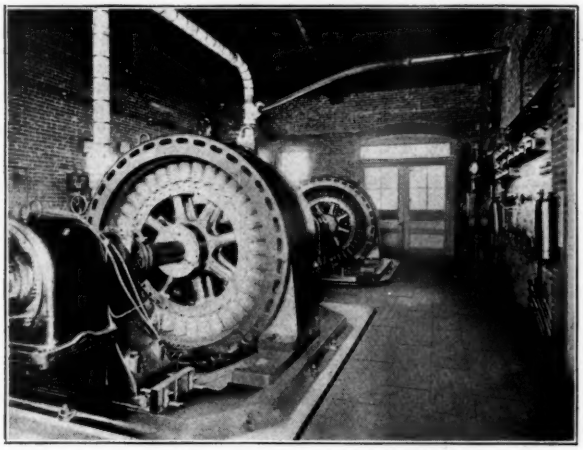
The installation for making ice consists of a compressor room freezing tank, storage tank room and flat cooler, with ice dump, from which the wagons are loaded, the ice being passed through a chute to the wagon platform or into the ice storage room. Over the latter there are fruit storage rooms as well as egg and meat storage rooms, while under the ice storage room is another space for cold storage purposes.

The engine room of the power plant is seen in the accompanying illustration, Fig. 1, equipped with two direct-connected engine generators of 125 k.w. capacity, and the switchboard seen at the right. One of these engine-generator sets is seen in Fig. 2, the four-valve engine being seen in the background, and it is maintained that with this unit it has been possible to attain an efficiency of 90 per cent. from the indicated horse power on the engine to the switchboard on two-thirds load.

The arrangement of the switchboard is neat and compact, all wiring and mechanism possible being placed at the rear of the board, which includes five panels. Beginning at the left the first two machine panels are utilized for the two engine generator sets, the third power panel supplying current for the motors throughout the city, the next panel being employed for the distribution of commercial incandescent lighting in East and West Loveland, while the fifth panel takes care of the street light system, divided into two circuits, for East and West Loveland.

The accompanying illustration, Fig. 3, shows the high duty cross-compound crank, flywheel, engine and pump and the duplex steam water pump, which is used as a duplicate equipment. Under these pumps there is a large cement container which holds about 45,000 gallons of water, into which a vertical centrifugal motor-driven pump, at a driven well on an island 2,600 feet from the power plant, is used to deliver the water. From this container the water is distributed under pressure to the city service.

The water is pumped from the cement container under a pressure of from 110 to 120 pounds per square inch, to a tank located a quarter of a mile from the



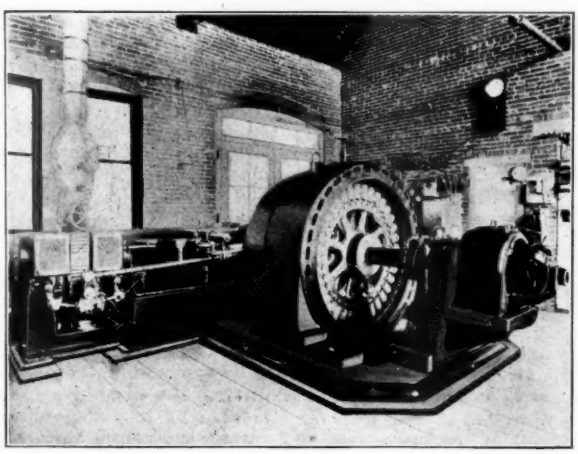
LOVELAND WATER WORKS, ELECTRIC LIGHT AND ICE PLANT.
1. Engine Room.

water works, this tank supplying the town having a capacity of 120,000 gallons.

The steam is supplied for operating this power station by two water tube boilers of 200-horse-power each, the feed water being supplied by two duplex pumps interconnected for supplying either of the two boilers in the boiler room. An elevator conveys the fuel to the storage room as it is dumped from the cars into a track hopper, the cost of unloading the fuel being very low. An accurate record is kept of the fuel consumed, the coal being weighed as delivered to the boilers by a special automatic weighing device, while the water is measured in the settling basin, the amount of water evaporated per pound of coal being accurately determined.

In the electric plant the two four-valve engines are directly coupled to three-phase alternators supplying a current of 2,200 volts with a frequency of 60 cycles per second. It will be noted from the illustration that the exciters are directly coupled to the extended shaft of the alternator, the arrangements being such that the bearings can always be adjusted to the shaft for maintaining perfect alignment.

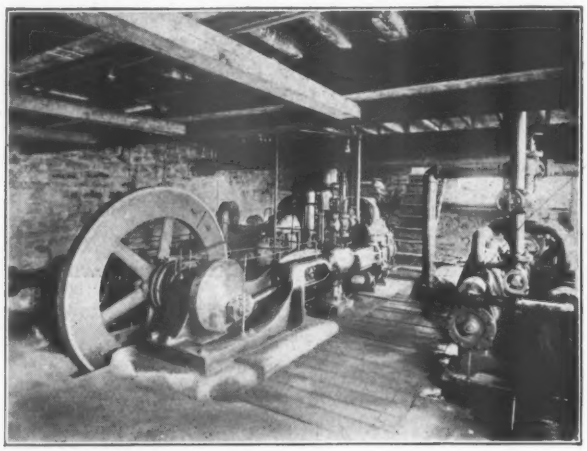
A remarkable fact is recorded that in this small town of Loveland every steam engine user has found it desirable and economical to install electric motors, the



LOVELAND WATER WORKS, ELECTRIC LIGHT AND ICE PLANT.
2. Engine-Generator Set.

engines being discarded, with a profit to the electric plant and a decided saving to the consumer as well.

By this combination of electric lighting, water pumping and ice making, it has been found possible by the management to give electric service day and night at moderate rates, the efficiency of the electric light plant being greatly increased, the power being utilized during light loads for ice making and pumping service to the city water storage tanks.



LOVELAND WATER WORKS, ELECTRIC LIGHT AND ICE PLANT.
3. Pumping Engines.

Term of Lease for Boston Subways.

AT the present time in Boston and New York the future transportation problem is before the public and the city. In Boston the discussion is centered more on the period of lease than on any proposed extensions, and the report of the Committee on Public Utilities, of which Mr. Dugald C. Jackson is acting chairman, to the Chamber of Commerce, distinctly shows that the committee believes a 25-year lease can be worked out on a fair basis.

The committee is unanimously of the opinion that it would not be in the public interest to give an option at the present time for the extension of the leases beyond 1936, with the possible exception indicated below. The advance in the methods of transportation during the past twenty-five years, and the increase in the number of passengers transported resulting therefrom, have been tremendous. What changes will take place within the next twenty-five years, and what the conditions will be at the end of that period, no man will undertake to say; and it seems a sacrifice of a most important power of determination to deprive the next generation of the opportunity to avail themselves of such improved methods of transportation and such desirable changes and additions to their transportation facilities as may at that time seem wise—the nature, extent, and importance of which cannot now be foreseen—and to decide for them, in advance of any knowledge, the conditions under which these subways, which may very likely always be the central and controlling factor in the transportation facilities of the city, shall be occupied and utilized. They are entitled to such transportation facilities as may at that time seem to them essential, and the cost of which they are willing to pay. What transportation facilities will be at that time essential, and the conditions under which it will then be fair to ask the Transportation Company to provide those facilities, are not at this time known.

It has been urged that the additional subways which the leases cover will not during the first few years of their operation bring in sufficient additional revenue to pay the rental thereof, at the rate fixed in the pending act, and that it is not fair to the company, and not in the interest of the public to ask the company to take a

25-year lease of them upon terms which would be fair for a 50-year lease.

It is obviously true that conditions which would be just and fair under a 50-year lease, and which would enable the company to finance its needs on favorable terms, may very well be unjust to the company and not in the interest of the public if the term is to be 25 years; but the committee points out that neither the company nor any public body or board has yet undertaken to say what terms and conditions of relief from other terms and conditions would be fair for the company if the term of the leases is to be 25 years. It is believed that if a vigorous, determined and intelligent effort is made to do this, a fair basis for 25-year leases can be worked out.

The committee unanimously recommends that at least until this is done and the public has had the question clearly presented for its consideration as to whether it prefers 25-year leases with whatever concessions by it may necessarily and properly accompany them, or the longer term leases with the disadvantages accompanying them, the Chamber oppose the passage of any act providing for the leasing of the existing and prospective subways for the longer period.

A Theoretical Formula for the Curve Resistance to the Flow of Liquids.*

By Philip J. Markmann, C. E., St. Louis, Mo.

THE resistance offered by bends in pipes or curves in open channels to the flow of liquids is a much-mooted subject in hydraulics.

We find empirical formulae for the loss of head due to bends in pipes by Du Buat, Navier, Weisbach and probably others.

These formulae, being empirical ones, probably cover the range of the respective experiments with regard to velocities, kinds, size and curvature of pipes under observation.

One of the contributions within recent years, in the line of experimental data, is the paper of Williams, Hubbell and Fenkell, of Detroit, entitled "Experiments at Detroit, Michigan, on the Effects of Curvature upon the Flow of Water in Pipes," published in the Transactions of the A. S. C. E. of April, 1902, vol. xlvii.

In the introduction to their paper they made this statement: "Having satisfied themselves that there were no data extant that an engineer was warranted in applying to the cases occurring in ordinary practice, nothwithstanding the unanimity of opinion expressed in hydraulic treatises, the writers have considered it unnecessary to present any resume of meager data supposed to bear upon the question in hand." etc.

This in itself is a rather remarkable statement of the status of hydraulic knowledge, and becomes rather sensational when supplemented by the authors' conclusions, on the basis of their own experiments, which are:

"The experiments taken as a whole prove beyond question or doubt that the hitherto accepted notions of the laws governing curve resistance are wholly in error.

"Curves of short radius, down to a limit of about 2½ diameters, offer less resistance to the flow of water than do those of longer radius, and hence the theories and practices regarding curve resistance, as set forth in the hydraulic treatises of all nations up to the present time, are absolutely incorrect and the diametric opposite of the true conditions."

Later on, when summing up the discussion and the criticism on their paper, these authors found themselves compelled to modify their above statement, as follows:

"In a given length of pipe, consisting of two tangents joined by a curve of 90 degrees, the loss of head will decrease as the radius of the curve is decreased, to a limit of about 2½ diameters, and will increase as the radius is increased above that limit, the total length remaining the same."

They insist, however, on the originality of their statement, that "the theories and practices regarding curve resistance, as set forth in the hydraulic treatises of all nations up to the present time, are absolutely incorrect and the diametric opposite of the true conditions," by saying: "An examination of the various treatises on hydraulics, contained in one of the most complete libraries in America, made before this paper was written, failed to show in Italian, Spanish, French, German, English, Canadian or American hydraulic textbook or manual a single statement to indicate that curve resistance

*A paper before the St. Louis Engineers' Club.

ever decreased with the radius, and likewise failed to show one in which it was not either directly stated or clearly intimated that long, easy curves offer less resistance to the flow of water than those of shorter radius."

We readily believe, without this emphatic statement, that such is the fact, because we cannot stultify ourselves by ever accepting Williams, Hubbell and Fenkell's conclusion to the contrary as true. Not one of the numerous contributors to the discussion intimated that the doctrine of Williams, Hubbell and Fenkell was not a new one to them.

Some time later, in 1906 and 1907, "Experiments by Brightmore on Curves in Four-Inch and Three-Inch Pipes" was published in Proc. Inst. C. E., of Great Britain. This investigator is the first one, apparently, who states that the excess loss depends, not only upon the radius, but also on the velocity.

Still later we have "Experiments by Schoder on Curve Resistance in Water Pipes, Six and Eight-Inch Diameters," published in the Transactions, A. S. C. E., 1909, vol. lxii.

We should also mention an earlier paper, "Experiments by John R. Freeman on Curves from Two to Four Feet Radius in Fire Hose," published in the Transactions, A. S. C. E., vol. xxi, page 362.

All these tests and empirical formulae refer to the flow in closed pipes. Nothing, apparently, is on record referring to any compensation for flow in curves in open channels.

The title given to this paper is, "A Theoretical Formula for the Curve Resistance to the Flow of Liquids."

The speaker does not know positively that a theoretical formula in some form has not been given somewhere. The sources which have been quoted and two well-known hydraulic treatises, "Church" and "Merriman," do not even allude to any theoretical formula.

The engineers of the sewer department of this city have for some time been aware of the obvious necessity of increasing the fall of the sewers in the curves, so as to compensate for the additional resistance caused by the curvature of the channel.

These curves, generally, are not what could be called "easy" curves, as the sewers are, as a rule, built along the streets, and in following the natural slope of the district, have frequently to make right-angle turns, and even greater angles, and these curves must all be within the intersecting street lines at the crossings.

The records show that at least some of the earlier sewers have been built without any increase in fall around and through such curves. In the opinion of the present management of the sewer department the lack of compensation for the additional curve resistance is to be held accountable, in some cases at least, for the congestion of some sewers during heavy storms and for the consequent claims for damages by flooded cellars and for many resulting relief bills passed in the settlement of such damages.

The slopes of all sewers designed in recent years have been increased through the curves in a more or less arbitrary way. The question of the proper amount of required compensation for the greater resistance to the flow in curves has been given a good deal of special attention. The speaker has been a party in the consultations on the subject, and has subsequently given his special attention to the question.

As the subject came up in this particular form, the investigation which the speaker made, naturally applied to the flow in "open channels." The compensation for the resistance which he found, as the result of his analysis, applies to the analogous case of flow in "closed pipes," as a special case.

The speaker will proceed to present in as brief and comprehensive a form as is compatible with a certain degree of completeness, the development of a theoretical equation for the curve resistance to the flow of liquids in "open channels," and will then show its application to the flow in "closed pipes."

PROBLEM OF OPEN CHANNEL DESIGN.

The problem of the most economical design of a drain requires the computation, of the smallest size of conduit which, for a given alignment and for a given total fall, will be just sufficient to furnish the given rate of flow, or, in other words, will have the required capacity.

Rankine speaks of "flow in an open channel" as "flow in a stream," and gives this definition:

"A stream is a moving fluid mass, indefinitely extended in length and limited transversely, and having a continuous longitudinal motion."

Continuing, he demonstrates that "the normal velocities at a given instant at two fixed cross-sections are inversely as the areas of these sections."

When a stream of liquid completely fills the "pipe" or "tube" or "conduit," the area of each cross-section is given by the figure and dimensions of the conduit.

A "channel" partially encloses the stream flowing in it, leaving the upper surface free, and this description applies not only to channels, commonly so called, but to pipes or conduits partially filled. In this case the area of a cross-section of the stream depends not only on the figure and dimensions of the channel, but on the figure and elevation of the free

upper surface of the stream. The upper surface is free to conform in elevation to the dynamic conditions governed by the channel.

In a stream not uniform as to velocity and section the loss of dynamic head is the sum of that expended in overcoming resistance and of that expended in producing increased velocity, when the velocity increases, or the difference of those two quantities, when the velocity diminishes.

In a stream uniform as to velocity and section the dynamic head is wholly expended at any point along the line in overcoming resistance.

If we have a straight open stream, varying in its cross-section as to figure and dimensions, while roughness and slope of bed are uniform, the velocity will vary from place to place inversely as the cross-sections.

The velocity of a straight open stream will likewise vary when the slope of the bed is not uniform, while roughness and cross-section of the channel are uniform.

Therefore a straight open stream can only be uniform as to velocity and section when the fall is uniform also.

When we have a bend in the line of the stream flowing in a uniform channel of a uniform fall neither the velocity nor the cross-section of flow can be constant or uniform.

But in a case where a stream follows an alignment, composed of tangents and curves, we can, nevertheless, have a uniform stream as to velocity and section if the slope of the bed of the channel varies in a certain way, governed by the changes in alignment in conjunction with the velocity. (The roughness of the bounding surface assumed as uniform throughout.)

Recognizing, as we are compelled to by experience if not by analysis, that the flow through any curved portion of the course meets with a greater resistance there than in the straight course, we must come to the conclusion that through the curve more potential energy has to be expended, or in plain words, more (mechanical) work has to be performed in overcoming the resistances than in the straight course, if a uniform velocity is to be maintained throughout.

Therefore, for a curve we have to ascertain the additional potential energy required; we have to provide for a variable potential energy, capable at any point to do the work of overcoming the respective local resistances, while maintaining a constant velocity throughout; and in such a stream of uniform cross-section and uniform velocity the dynamic head is, as stated, wholly expended at any point along the line in overcoming resistance.

The principles and laws of dynamics applied to this problem will furnish the theoretical solution, which will be taken up in the next section of this paper.

Financing of Public Utilities.*

By Robert J. Graf.

THE commercial and mechanical advancement in the electrical field could have been realized only through the moneys invested in the respective enterprises. In contemplating the large electric generating plants and the great businesses established, even those in the business lose sight at times of the great debt we owe to the financial interests who furnished the sinews of war in the early days of the industry.

The capitalization of upwards of $1,500,000,000 in central electric stations is held by the general public. The securities are held by all kinds and conditions of men, residing in every State of the Union, and I might almost say in every civilized country of the world. In several of the companies of which I am an officer, more than 40 per cent. of the dividend checks are paid in foreign exchange. England and the continent have contributed huge sums of money to the development of the electrical utility business in this country.

One difficulty in the way of financing a public utility property, up to within less than ten years ago, but which to a great degree gradually has been overcome, was the finding of a ready market for these securities. The majority of investors, when they buy a security, want to know how quickly, in case of necessity, they can turn the securities into cash.

Owing to the number of companies engaged in the business—the average cost per plant as given in the Census Report of 1902 was $140,000; in 1907, $200,000; which would divide the capitalization over some four or five thousand companies—it will readily be seen that the in-

*Abstract of an address before the Electric Club of Chicago.

vesting public would require special information on almost innumerable projects to judge the merits of the various securities offered. Even today there are comparatively few electrical public utility securities listed on the great exchanges of the country. The causes outlined left the investor a limited sale outlet—the bond house or banker from whom he had purchased the securities, and a limited local market for the absorption of such securities as would be offered for sale. Under these conditions the average investor preferred to place his funds in securities which had a readier market and which, on short notice, he could convert into cash. Thus electrical securities could not compete in the broad market enjoyed by industrial, railroad and other securities listed on the stock exchanges of the country, but had to rely upon a limited class of investors attracted by the high interest return offered by utility companies for funds invested in their enterprises, or the comparatively small groups of men who realized the potential possibilities of the business and were willing to invest their funds simply on its merits.

Within the last ten years, however, the market has been greatly broadened, primarily by the realization on the part of the banking and bond interests of the intrinsic value and permanency of the industry, coupled with the fact that the business could pay, and in fact, in order to finance itself had to pay, higher rates of interest than other enterprises of like magnitude.

This was an entire reversal of form—electrical securities now being sought for market, instead of seeking a market. This is literally the case, as practically every leading banking or bond house now stands ready to purchase any amount of securities of well-managed public utility properties, while less than ten years ago the conservative financial interests would not finance electrical projects at all except those located in the large urban centers.

A new departure in the method of financing, which also has aided greatly and broadened the market for the sale of securities, is the consolidation under one management of a number of comparatively small utility plants, and through this combination the formulation of a scientific, economical and comprehensive financial plan. In this way the smaller plants in a great many instances have been financed through being grouped with other properties within operative radius, where as separate propositions, serving small populations, they would be impossible to finance by themselves. In addition to ability to finance upon a satisfactory basis, the grouping together of separate units has resulted in giving to the smaller properties highly scientific management in all departments, and through this management rendering to the community served a better service at a lower rate than possibly could be effected otherwise.

Economists for years have admitted as a fact that public utilities should be operated as monopolies and should not be subject to competition. The general public has begun to realize from many costly experiences the truth of this assertion, and largely due to educational propaganda on the part of the companies, the public attitude has entirely changed. I believe that it would be an almost impossible task to secure in a community that is at present served by a well-managed and properly conducted utility company a competitive franchise of this nature.

The newness of the business and the apprehension on the part of investors of changes which might occur over night, so to speak, which would entirely revolutionize the method of production, or render useless generating plants installed, was a fear that has been entirely overcome through standardization of the method in cost of electrical products.

Fundamentally applying to this business, as well as to all other business operations, the earning capacity is primarily the one considered by the investor. In this regard the electrical utility business has demonstrated its capacity and its ability to pay, as it has had to do, high rates of interest on its securities. While the earnings of practically every well-managed utility company in this country have steadily increased, the increase in the gross and net earnings of the electrical utility properties was particularly noticeable and was given great publicity in the year 1907, a so-called "panic" year. In that year every local utility property with which I am connected, situated in all parts of the country, increased its connected load and its gross and net earnings very appreciably. I believe you will find this to be the case of practically all utilities in the country, although in the same period of time the earnings of railroads, industrials and other companies practically without exception decreased materially.

EDITORIAL COMMENT

Competition in Public Contracts.
Gas Rates in Chicago.

COMPETITION IN PUBLIC CONTRACTS.

The discussion of Major Gillette's paper before the American Society of Engineering Contractors upon "Competition in Public Contracts," the conclusions of which were given in the July number of MUNICIPAL ENGINEERING, promises to be interesting and somewhat extended.

There are so many side lines of interest that it is rather difficult to keep close to the main point in the paper and not emphasize the features which belong really to other discussions, thus leading one away from this subject. Some of these side lines are quite as important as the main subject but they must be kept in the background, but not completely eliminated, if this discussion is to be of the utmost value.

To begin with the latest communication, that of Mr. Dieck, in the department "From Workers in the Field," elsewhere in this number of MUNICIPAL ENGINEERING: The first point made is that the public will be suspicious of a reform advocated by those most directly interested. This, it seems to the writer, is apart from the question, partly because Mr. Gillette is an engineer and not a contractor in the technical sense of that term, and partly because the value of a reform does not depend upon the source from which it starts but upon the need for the reform and the way in which it works out. If the agitation is started for the sole benefit of the contractor that fact will soon appear and the discussion will fall flat. If it is started or is carried forward for the general benefit, then the rate of advance of the discussion will depend upon the interest in it shown by those most concerned, whatever the nature of their connection with the business. It is notable that most of the interest thus far manifested, some of it not yet in print, has been by the engineers or by contractors who are at the same time engineers, those from which the American Society of Engineering Contractors derives its name and who form the nucleus and the greater proportion of its membership. The movement has every indication of honesty in inception and purpose, and its initiation by an engineer who is by nature, training and official history, independent of any entangling influences, is further evidence to allay any suspicions as to motives.

Both Mr. Dieck, and Mr. Warren in the August number, declare that the needed reform must come through the action of the engineers. This is undoubtedly true to a very large extent, and the education of the engineering profession in general is an essential to the complete solution of the problem, but this is one of the important side lines and must be left to separate discussion, this statement of its importance being all that can be used in connection with the subject strictly covered by the title of Mr. Gillette's paper.

The strictures on the administration of civil service laws are also pertinent to this discussion only in a single statement. Major Gillette has grown up in the red tape of the War Department and is thoroughly familiar with it, and, like other officers in the Corps of Engineers, can handle any matter of construction satisfactorily under its restrictions, where one brought up in the systems or lacks of system prevalent in other construction work finds himself tied hand and foot. It is natural therefore, for Major Gillette to recommend legal provisions which will bring about the result

to which he is accustomed, and to condemn the lack of system which he found in municipal public work, under which he was perhaps as helpless as the ordinary civilian would be if dropped in the midst of governmental red tape. Some of those with more or less knowledge of both methods of handling construction work ventured the prediction that the Panama canal administration would not succeed under the red tape surrounding the expenditure of governmental funds until it was put into the hands of officers of the Engineer Corps, men familiar with the system, if there were any large enough for the job. The result has justified the prediction and has demonstrated that the Engineer Corps has men suited for any duty that may be required of them. It is quite probable that the same officers, if put in charge of as large a machine operated according to the methods of the great railroads, would find themselves unable to manage it successfully.

These statements may throw light for some readers upon the reason for the form of Mr. Gillette's recommendations, and upon the reason for the objections made by those brought up under less restricted systems to the laws proposed by him, and thus reduce the misunderstanding of motives. They refer, of course, mainly to the financial transactions in construction operations and not to the engineering features, although the provisions of the civil service laws do impose some restrictions upon the latter.

Proper administration of a good civil service law will undoubtedly improve conditions surrounding the letting of public contracts, but the civil service question must be set aside for separate discussion.

Some excellent contributions to the discussion are promised for the October number of MUNICIPAL ENGINEERING, and our readers are invited to add to the number. Discussion of each of the above questions, which have been separated from the main question, is also requested, with the suggestion that each question be considered separately in its direct relations to the main question, or quite independently of it.

GAS RATES IN CHICAGO.

The report of the investigation of the rate proper to be charged for gas in Chicago, made by William J. Hagenah for the gas sub-committee of the Chicago council committee on gas, oil and electric light has been published and is of much interest. The sub-committee consisted of William J. Pringle, Theodore K. Long and Charles E. Merriam.

The report opens with a brief historical sketch of the gas companies in the city, showing the development of the present company with its $35,000,000 of stock and $40,096,000 of bonds, income of $15,500,000 a year, paying about 5 per cent interest on bonds and 7 per cent dividends on stock.

The methods pursued in making a valuation of the property are set forth in detail, with some indication of the methods of selecting unit prices, determining cost of details, etc, concerning the physical property, including the overhead construction charges. The valuations of these details are given in the report only in summaries.

The overhead construction charges included were computed for three equal portions of the life of the company. For the first period the allowance is 22 per cent, for the middle 17 per cent and for the last 12 per cent, or an average of 17 per cent for the three periods. Land is not included in the above, the charge on the present value of the land for the overhead construction charges being reduced to 12 per cent. A further allowance of 6 per cent for discounts made in the sale of bonds on the market is made and defended by argument and brief general statement of facts.

The total depreciation to date of report is less than 14 per cent of the computed cost new.

After careful comparison of the accounts for gas stores, accounts receivable, pay roll, cash, current liabilities, etc., the working capital is fixed at $3,200,000, approximately $1,000,000 of which is the minimum of cash to keep on hand.

Concerning the omission of the value of the franchise from the valuation of the plant for purposes of determining the proper rate to charge for gas, the

report says: "A franchise authorizes the use of private property in a particular manner and generally conveys an exclusive right. In this particular instance the right issued from the people for the specific purpose of having the grantees of that right use it for the public good in the operation of a gas utility and with such profit to themselves as was represented by a reasonable return upon the capital actually invested. There is no proof that the company paid any value for this original right. It was a grant for which the people received nothing in return except the service to be furnished. The company made no franchise investment of its own at the time or thereafter. Its expenditures in constructing the gas plant and the development of the business represented investments in the business and not in the franchise. It is only by virtue of the franchise that the business itself could be developed. The mere granting of such a franchise or privilege conveys with it no right on the part of the grantees to a separate value in the franchise above the amount paid for it, distinct from its use in the business for which it was granted, which the parties may capitalize as against the public in rate adjustment proceedings. To grant a value for the franchise as against the public, when no payment was made therefor to the public, would be to increase the value of the investment of the company and hence increase the cost of gas."

The cost of securing business is quite thoroughly discussed and the various empirical rules for estimating it are compared, and the results are shown to differ within a range of some ten per cent or more.

The total cost new of the whole plant, $49,023,947, is subject to a reduction of $6,786,538 for depreciation, and an increase of $3,200,000 for working capital. The allowances for these items and the cost of getting business are worked out year by year, beginning with a total value of $39,000,000 in 1897, and making the additions for 7 per cent return on investment, for additions to plant and interest thereon and for operating expenses, and deduction for gross earnings. The result each year is the cost of the plant for that year, with which to start the computation for the next year. This process brings the total cost of the plant at the close of 1910 to $60,933,630. To this is added $916,249 for construction work not yet technically completed, making the total $61,849,879, as compared with the total stock and bond issues of $75,096,000.

This excess, except such part as is promotion charge or water, is undoubtedly value of the franchise as a revenue producer under the conditions as they have existed heretofore. It is now recognised that this franchise value, which has never been paid for by the company, is the property of the city, and should not be considered as a part of the capital of the company on which the consumers of gas must pay interest or dividends.

When natural gas and property not used used in the artificial gas business is eliminated, the value of the artificial gas plant becomes $51,575,678, upon which interest, depreciation, etc., for such plant must be computed for 1911.

The revenues and expenditures are briefly analyzed, and with some minor adjustments are accepted as correct. The charge to be made for the future for depreciation is then discussed and an average of 2 per cent of the depreciable property is allowed as a charge against the revenues of the plant before determining the net profits. Likewise 7 per cent is demonstrated to be a fair interest return upon the valuation of the property.

The final tabulation in cash and in cents per thousand feet of gas made, is as follows:

Operating Revenue.			Per M Sold
Gas Sales	$13,663,168.01		$0.8496
Tar Sales	130,944.03		.0081
Penalties	167,462.09		.0104
Arc Lamp Rentals	340,873.31		.0212
Total Operating Revenue		$14,302,447.44	.8893

			Per M Made
OPERATING EXPENSES.			
Manufacturing—			
Steam Material	$ 160,451.74		.0112
Generator Material	2,874,299.24		.2007
Purifying Material	11,541.61		.0008
Station Supplies	30,279.35		.0021
Manufacturing Labor	341,832.68		.0239
Works Repairs	117,845.48		.0082
Engr. Dept. General Charges	45,897.73		.0032
Total		3,582,147.83	.2501
Gas Purchased and Allied Expenses		748,157.06	.2965
Distribution—			Per M Sold
Distribution Station Operation	$ 82,924.54		.0052
Street Mains Maintenance	331,297.94		.0206
Service Pipe Maintenance	146,905.32		.0091
City Lamp Post Maintenance	16,599.98		.0010
Meter Maintenance	313,799.99		.0195
Gratuitous Work	151,112.78		.0094
Arc Lamp Maintenance	308,701.58		.0192
Total		1,351,342.13	.0840
Commercial Expense—			
Promotion Expense	$ 139,701.50		.0087
Branch Store Expense	22,355.32		.0014
Appliance Expense	104,702.22*		* .0065
Total		57,354.60	.0036
Office Expense:			
Turn On and Off	$ 61,752.89		.0038
Statement Taking	96,918.76		.0060
Bookkeeping	165,082.99		.0103
Collecting	136,025.56		.0085
Applications, Receiving, Auditing, etc	236,637.63		.0147
Total		696,417.83	.0433
General Expense—			
General Office Expense	$ 397,834.55		.0237
Telephone Rentals	21,666.02		.0013
Rent	156,219.79		.0097
Legal Expense	26,338.56		.0016
Claims and Damages	54,000.00		.0034
Employes' Aid and Pensions Fund	133,372.00		.0083
Uncollectable Bills	60,508.01		.0038
Fire and Property Damage	42,,000.00		.0026
Main Rentals	53,493.00		.0033
Lease Rentals	340,000.00		.0011
Total		1,267,431.93	.0788
Taxes		848,115.00	.0527
Depreciation		642,487.00	.0399
Sundry Revenue Requirements		153,941.00	.0096
Total Operating Expenses		9,347,394.38	.5812
NET EARNINGS.		4,955,053.06	.3081
Non-Operating Utility Revenue:			
Interest	$ 50,000.00		.0031
Rentals	17,591.06		.0011
Miscellaneous	11,704.57		.0007
Total Non-Operating Utility Revenue		79,295.63	.0049
Gross Corporate Income		5,034,348.69	.3130
Deductions from Gross Corporate Income:			
Return on Investment at 7%		3,610,297.00	.2245
SURPLUS		$1,424,051.69	.0885

*Profit credited.

The surplus assumed at 8 cents per thousand cubic feet is taken to be the excess of revenue which the company receives beyond a fair return. It is therefore recommended that under present conditions the rate should be 77 cents instead of the present rate of 85 cents per thousand cubic feet.

The present requirements are 22 candle-power and 600 B. t. u., and the company supplied in 1909 24 c. p. and 685 B. t. u., on the average. Reduced to the standard of other large cities, gas could be supplied for about 73 cents per thousand, and this superiority in value must be considered in comparing the price computed as above with that in other cities, especially those having particularly low prices.

The final conclusions are presented in the following table:

Chicago Gas Rate.	1910.	1909.
Total value of investment	$61,849,879	$58,060,210
Total value of physical property	49,023,947	44,494,972
Total "going value" as defined in the report	9,425,932	10,365,238
Gas utility investment, including used proportion of office building		53,075,598
(Office building excluded from income account investment and rental charge for space occupied provided.)		
No allowance made for value of franchises.		
No allowance made for the cost of street pavement over the Company's distribution system not paid for by the Company.		
Allowance for working capital		$3,200,000
Allowance for depreciation		642,487
Allowance for taxes		848,115
Rate of return allowed on the investment		7%
Gross operating revenues		14,302,447
Non-operating revenues		79,296
Present actual earnings available for interest and dividends		5,034,349
Allowance for return on present value of utility investment at 7%		3,610,297
Surplus in 1909 after allowance for interest and dividends		1,424,052
Present rate for gas	95 cents per M gross—85 cents per M net.	
Rate recommended	87 cents per M gross—77 cents per M net.	
Saving to public at 77 cents per M on 1909 basis		1,282,299
Probable saving in five years		7,400,000
Earnings available for interest and dividends under proposed rate.		3,752,050
Surplus under proposed rate after allowance of 7% for return on investment		141,753

The report seems to be upon a fair basis, and so it falls between the demands upon the one side that the rate be reduced to 70 cents and on the other that it remain in the neighborhood of 85 cents. It doubtless represents Chicago conditions, although there is a slight tendency in some places toward rather high valuations. When compared with the Indianapolis rate, with which the writer is somewhat familiar, several reasons for the higher rate in Chicago are shown. While the heat requirements are not far different, Chicago seems to be getting gas with somewhat higher heating value. Chicago has a high lighting requirement while Indianapolis has none for the new company and is not required to treat the gas to bring up its candle power, thus saving some money. The by-products of the Indianapolis plant are far more valuable and their sale reduces the cost of the gas as manufactured to a very low figure. The distribution system with which the Indianapolis company began business was purchased at a low price, which reduces the interest charge to some extent, though ultimately it may increase the expenditures for pipe renewals, though this promises to be rather remote. The charge for getting new business was also less in the Indianapolis case, much of the early business being anxious for the service and requiring only slight modifications of the pipes and connections to utilize the new system.

THE QUESTION DEPARTMENT

Foundation for Sewer in Quicksand.

We are constructing a five-foot reinforced concrete block sewer of Parmley and Nethercut construction in our city. The sewer is going to be built along the course of a creek, so there will be more or less water flowing in the trench all the time. We will probably encounter some quicksand. Will you please let me know what would be the best method to secure a good foundation on the same.

W., ———, Wis.

The exact method to be used can be determined only by the engineer or contractor on the ground, for any method proposed must be modified to suit the special difficulties met, and one method may not be applicable while another may be quite successful.

The article on "Sewer Trenching in Wet Sand" in MUNICIPAL ENGINEERING, vol. XXXV, p. 143, describes in considerable detail a method of pumping the water out of the sand by means of well points driven into the ground ahead of the excavation, so that the sand can be shoveled out with ease and the water can be kept down below the bottom of the excavation until the sewer is laid.

In many cases no special foundation is necessary, provided the water is kept below the sewer until it is thoroughly set in place and filling over it has begun.

Folwell's "Sewerage," ($3) devotes considerable space to methods of handling quicksand, nearly all of which proceed on the principle that a sub-drain should be laid under the sewer to keep the water down and that gravel or broken stone or in some cases cinders should be filled in around this drain tile to the level of the bottom of the sewer, this filling being sufficient foundation under ordinary quicksand conditions. Cradles or concrete are also described for use when the looser form of foundation is not sufficient.

Quicksand can frequently be drained by keeping a length of trench open for a considerable time so that the ground water can be drained down, when extension of the trench will find comparatively dry soil in which to work. This is less expensive of money, though more expensive of time, than the wellpoint method described, when it is applicable. In a rainy season or in a wet climate, methods of getting rid of the water which require much time are not so applicable, for the water in the source of supply is renewed too frequently for the drains to have full effect.

Books on Water Works.

I would like to get a book or set of books especially on the placing and construction of water plants. I would want the best and up to date books that are now printed. I have an encyclopedia of civil engineering, which devotes almost one volume to the subject of water works; but you will understand that I want a book or books alone devoted to subject spoken of above.

M., South Sharon, Pa.

Probably the best books for our correspondent's purposes are Folwell's "Water Supply Engineering" ($4) and Turneaure and Russel's "Public Water Supplies" ($5). The latter is the more comprehensive, but the former has some practical details of construction which should be very valuable for the young engineer.

Customary Measurements of Curb and Gutter and Pavement Areas.

I should like to hear through your question department as to what is the custom generally followed by engineers in making final estimates on paving. On concrete curb and gutter is the space taken up by inlets deducted from total length as estimated to contractor, or the total length including inlets given as final measurement? And in brick pavement with cement filler where large expansion joints are left at gutters, are expansion joints included in the area of pavement in final estimate?

I have known cases where engineers have made estimates both ways and should like to hear what is considered fair to both municipality and contractor on this point.

L., ———, Ill.

Will our readers report their practice? The writer measures the entire length of curb without deducting inlets, the extra work in finishing curb at inlets and setting the same being considered equal to the displaced curb and gutter. The inlets or the catchbasins are also charged at the price bid, which includes the furnishing of the materials and the construction of the basin or inlet connection.

In measuring area of pavement the entire area between gutters is measured, the expansion joints being included in the area of pavement. Their presence increases the cost of the pavement and they are as truly a part of it as is the regular surface. The writer knows of no place where the expansion joints are paid for separately, and they must certainly be paid for.

Duplicate Water Supply Systems.

Can you advise the writer of any city or cities having a population of ten to twenty

thousand, who have installed and are using the duplicate system of water supply, one being for domestic use and the other for street, lawn sprinkling, and other purposes?

We have a limited unexcelled pure water supply, and there is being developed a sentiment among certain citizens in favor of such a system, and the writer is endeavoring to get some information on the subject from cities that have followed this course.

Board of Public Works,
———, Mich.

Can our readers refer us to such systems? Fifteen or twenty of the larger cities in the United States now have high-pressure fire systems which may be used to some extent for the purposes mentioned, but not largely, because they usually cover only the districts of special fire hazard or congestion in the business and manufacturing parts of the city.

Concrete Mixer for Asphalt Paving Materials.

Can a concrete mixer be used for mixing asphalt paving materials?

It seems to me that a common mixer in conjunction with a sand drier and asphalt kettle would have certain advantages over a regular paving plant for small jobs.

Have any of your readers had any experience along this line?

R. F. S., San Francisco, Cal.

Some concrete mixers would be very unsatisfactory as mixers of asphalt paving materials while others might work very satisfactorily. The principal requirements in an asphalt pavement mixer are ease of passage through the mixer so that the cooler material sticking to the sides will not clog the machine, small area of sides and blades of mixer to reduce the cooling area to a minimum, rapid movement of blades of mixer and thorough stirring of the mixture so that the batch can be dumped as quickly as possible before it has an opportunity to cool, freedom of danger of clogging of the axis so that the mixer is not in danger of stopping on this account, no corners in which the mixture can lodge, openness of construction so that cleaning of the mixer by means of tools or of heat is easy.

Many concrete mixers will not answer any considerable number of these requirements, and none of them answer them all. It is quite as easy to mount an asphalt mixer on a portable truck as to use a concrete mixer, and the machine will cost no more.

For a single job the concrete mixer could be used, but it is quite probable that the mixer would be seriously damaged for use as a concrete mixer thereafter.

For small jobs it is quite common to use a heated pan and mix the paving mixture by hand, but for continuous small work with a portable plant the mixer can be used.

Several such portable paving plants of various sizes are on the market, such as the Atlas Dryer Co., Cleveland, O.; the Continental Asphalt and Equipment Co., Chicago, Ill.; F. D. Cummer & Son Co., Cleveland, O.; East Iron and Machine Co., Lima, O.; Iroquois Iron Works, Buffalo, N. Y.; Tidewater Iron Works, Hoboken, N. J., and others.

Depreciation in Cast Iron Pipe.

The town is considering the purchase of the water works system owned by a private corporation, and in appraising values the question has arisen as to the proper rate of depreciation to apply to the equipment in general. We have data at our office, which we can furnish the council with respect to the proper rate of depreciation on steam boilers, steam pumps, buildings, etc., but have no data relative to the proper rate of depreciation to apply to cast iron and wrought iron water pipes, hydrants, etc.

We infer that you may be in possession of considerable valuable data on this subject. If our inference is correct, we would be pleased to have you wire us Monday at our expense, whatever data you have with respect to the proper rate of depreciation to add to a water plant and equipment in general, especially pipe and hydrants.

The larger mains are, of course, cast iron, with bell and spigot joints, lead calked. The soil that they are laid in is principally gravel, with some clay. The greater portion of the pipe has been in the ground for approximately 28 years. The pressure carried has averaged 50 to 60 pounds. The water, a greater portion of the time, has been collected from streams and springs three or four miles from town, and, as far as we know, has contained nothing injurious to the pipe. Probably one-fifth of the time well water has been furnished. This has been rather hard, but, as far as we know, there has been nothing about this that would be more than ordinarily injurious to the pipe and equipment.

The mains are from 6 to 10 inches in diameter, and the distributing portion has been cleaned once only by having a scraper drawn through. This cleaning was performed last year.

The information, to be of value to us, should reach us Monday, and if received from you will be of considerable value in checking up the appraisers. Do not hesitate to make your telegram lengthy, if necessary to fully cover the matter.

L., ———, Pa.

Cast iron pipe will last fifty to eighty years, wrought iron half as long, both estimates being approximate averages, dependent on soil conditions. Fifty per cent. depreciation in thirty years is a fair allowance, if exact information is lacking. It is safest to make examination of pipes in numerous places in normal condition and where electrolysis or chemical action is possible, which, quite probably, will show higher present value of pipe in general and lower present value where electrolysis or soil conditions are dangerous. Hard water is probably favorable to life of pipe. The cleaning should have supplied some valuable information. Examination of pipe at least once a mile, where conditions are uniform, and oftener in critical areas, is recommended, if accurate estimate of value is wanted.

Estimates of depreciation are all right in making estimates of the probable necessities of a plant as to raising money to replace parts which are worn out, but when it comes to the problem of determining what the present value of a plant is, this method is not very accurate, because the deterioration

of a plant depends upon so many special conditions that any general allowance made in advance may be quite far from the truth in any particular case. In this case, assuming a street railway system, some parts of the city may require much less allowance for deterioration than other parts, and it would, of course, be impossible for an engineer to give any definite estimate of the present value of the different parts of the plant without an investigation. It will not cost much to dig a few holes, so as to uncover portions of the pipe in different parts of the city in sufficient numbers to make a very close approximation to the present value of the pipe.

In Indianapolis a rather careful estimate was made of a system of wrought iron gas pipe which had been in the ground for nearly twenty years, and they were valued at about one-half their cost to replace new, but when the pipes were put into condition for operation under the new conditions, it was found that they were practically as good as new, and that all that was necessary to put them in operation was to make the changes necessarv to fit them to the new conditions. This was true with respect to all of the system except near one or two streams, and where there was electrolysis.

From the point of view of the water works company it would be desirable to show that the water pipes generally in the city were in practically as good a condition as when they were laid. It is very possible that this is true. A hard water will not affect the interior of the pipes materially, and the character of the sediment which was taken from the pipes in the process of cleaning will show what, if any, has been the effect of the water on the pipes. It is quite possible that there was no effect.

The holes dug, as suggested, would uncover the outside of the pipe, and it could be determined whether there had been any action of corrosion on the outside of the pipe.

On the city's side it would be desirable to show whether there has been electrolysis, or whether in certain localities, especially those where considerable filling has been done, there might be chemical action upon the outside of the pipe which would render it less valuable because its life had been shortened. A few holes dug to determine the condition of the pipe, and an electrolysis survey to show where there was danger of pitting on account of electrolysis, would make it easy to show what parts of the system had deteriorated and might possibly be of no value, because the pipes should be shortly taken up and replaced. This examination should be made by an engineer who has made a study of this subject.

Metal Monuments Set in Concrete Walks.

I have been looking for some descriptive matter relative to metal monuments made of aluminum or brass disks, to be set on the five-foot line in concrete walks. Can you send me a cut or descriptive matter concerning this?

J. B. H., Connellsville, Pa.

The simplest marker of this sort is a small section of brass or copper rod, set in the concrete, so that it will be flush with the surface and will extend through the wearing surface and be embedded in the foundation layer. It is easiest to set this when the walk is laid, but it can be set in place by carefully boring a hole in the walk, the length of the rod and slightly larger in diameter, and then embedding the rod in cement mortar so that it will be held firmly in place. The top of the rod should be smooth and conform with the surface of the walk. The sides may be roughened to give the cement a better hold. The exact center of measurements may be marked by two deep chisel cuts at right angles to each other. If the walk is subject to wear, the cuts can be deepened as the rod wears, by a couple of additional blows on a chisel.

Will our readers give descriptions of any markers of this sort that they may have used?

Other forms of street monument are described in articles in MUNICIPAL ENGINEERING, such as those for house sewer connections, in vol. xl, pp. 130, 225; for boundaries, vol. xxxix, p. 203; for sidewalk nameplates, vol. xxxii, p. 246; on establishing monuments, vol. xxix, p. 432, and xxvii, p. 258; on concrete street monuments, vol. xxv, pp. 26 and 88, and xxiv, p. 433, etc.

Illinois Law for Straightening Streams.

Upon the advice of our city engineer I am writing you this letter. You will note by referring to the Revised Statutes of Illinois, 1909 edition, section 334, of chapter 24, and the paragraphs immediately following, that certain rights are given to cities and villages therein. I should like to know whether any city or village in the State of Illinois has ever straightened a natural channel and collected for the same by special assessment, under section 334, of chapter 24, and paragraphs immediately following. I have carefully looked into the matter and have never found whether that has been done by special assessment by any city or village in our state. H. & S., ———, Ill.

The drainage law of Illinois can apparently be applied to cities as well as to country districts. The only cities known to the writer to which it is proposed to apply the law are Champaign and Urbana, by means of extensions of the work of the Saline Branch Drainage Commission. This work has not been done, but the preliminary plans have long been under discussion, and there is no question of the applicability of the law, even though covered storm water sewers compose most of the works contemplated. The cost would be met by assessments on the property benefited. The writer knows of no instance in which the particular act referred to has been used.

Can our readers give names of other Illinois cities acting under either of these laws and some statement of the work done or proposed?

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited.
Give from your experience for the benefit of others.
Never mind style of composition, the fact is what is wanted.

Letting of Contracts for Public Improvements.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The earnest effort of Major Gillette to improve the methods in operation in the letting of contracts for public improvements, which received your attention in the July issue, and was later discussed by Mr. Warren, calls for more than a passing discussion by engineers. It is a serious endeavor to better a very difficult situation, yet in my humble opinion the solution presented is not adequate and reveals some decidedly weak points. Although, as Mr. Warren asserts, the great mass of contractors is not to be broadly charged with dishonesty in the execution of their contracts, yet the attempt to originate any reform from among any association in which they are the controlling element will undoubtedly bring public mistrust at the very inception of the movement. Such reform must, in my belief, come through action of the body of engineers.

Specifications for public work are usually drawn either in a very loose and insufficient manner or with the greatest severity. With specifications of the first kind, the unscrupulous contractor anticipates large profits from an interpretation of the contract other than the intention of the engineer. With those of the second, he expects a liberal interpretation by the official in charge, and, though adjusting his bid to allow for rigid enforcement, looks for a larger margin of profit in a milder enforcement than the specifications would seem to require. Severity in specifications has often frightened off an honorable contractor, and has left the field to the favored one, who, through influence or pressure, has been able to accomplish his selfish ends. The public cannot hope to secure the most favorable results by either one or the other of those methods of drafting specifications. Either the contractor, so minded, will endeavor to take advantage of every technical point to avoid compliance with the intention of the contract, or he will seek by devious means to secure favorable rulings. It is to circumvent just such harpies that the proposed legislation of Major Gillette is designed, though his proposition makes, too, for unreasonable severity in some regards.

In the third suggestion he urges publication of the advertisement for bidders in three local papers of general circulation in the community in which the work is to be undertaken. In such a sparsely settled country as Oregon, where population is scattered and the public press is rather restricted, the matter could hardly be handled in this manner. Recourse ought therefore to be had to the reputable technical journals, and notice in one of the local papers of acknowledged standing ought to be sufficient. This is not an insignificant point in that section, for though the population be quite small, considerable work in municipal improvement is being undertaken. There need, consequently, be no such arbitrary subdivision of contracts into classes as proposed, but all advertisements for work—of sufficient volume to attract other than local bidders—might be made on the same basis. The limit for this amount ought to be rather liberal, for the assembling of contractor's plant in the western country often interposes considerable difficulties and expense. The limit of $100 for purchases in the open market without the formality of inviting bids is inoperative, for the official facing an emergency requiring a greater expenditure will be tempted to split up his order into several parts and to place it so that the letter of the law would not be violated. This technical violation of the law has often been committed and without a rigid examination of accounts is not easily discoverable. As Mr. Warren well remarks, there is implied in such an attempted regulation a mistrust of public officials and an unreasonable restriction is imposed upon them. It is far more sensible to place the matter more freely in the discretion of the official and to hold him accountable for his actions. This, of course, implies at the same time that the body of officials will be actuated by good motives, still by proper selection and retention the result may be good.

The proposition to reduce the length of specifications to the simplest and most inelastic language calls for the hearty agreement of all engineers. It is common knowledge that the terms used in many specifications admit of the widest interpretation and open the way to constant and disagreeable discussion and controversy. The practice of covering the matter by protracted descriptions is worthy of the greatest censure, and

until this practice is corrected the engineering profession must continue to be subjected to severe criticism. The submission of doubtful matters to boards of arbitration is an excellent suggestion, yet if the plan outlined by Major Gillette be carried to its ultimate analysis, it defeats itself. The courts, as is well known, are jealous of interference with their functions, yet they will undoubtedly view with favor adjustments of difficulties, provided questions of fact only are concerned. In the plan proposed the contractor, though agreeing to abide by the decision of the board of arbitration, is privileged at any time to transfer the matter to the courts, and the whole object of the board will be defeated. It will be impossible to secure complete adjustment of all difficulties by any such artificial arrangement, yet many of the unpleasant and inconsequential controversies that now block our courts would be quickly dissipated. The courts would unquestionably view with disfavor any effort to suppress the right of a citizen to make objection to the manner of settlement of a difficulty, still if they felt that no serious interference with constitutional rights had been imposed, they would soon come to regard the plan with some concern. In the long run the best interests of the community will be served by such boards, for decisions will be immediate, and what is more to the point, made by experts on the spot.

The suppression of the words "discretion of the engineer" or others of like intent, cannot, in my opinion, be reasonably allowed, for in the course of any work questions must arise which no specifications, however carefully drawn, can comprehend. The board of arbitration might as a board of appeal settle such a difficulty, but frequently contingencies arise that even this artificial expedient could not in proper time determine. The effect of the section certainly is to make the official merely a watchdog, without the presumption of reasonable intelligence. It is true that a multitude of sins have been committed under the protection of this saving clause, still the official who values his self-respect and a reputation for fair dealing does not call this clause to his aid without sufficient warrant. The policeman, although armed, does not enforce his orders by display of his weapons, but in time of stress he is in position to meet the contingency. In somewhat a similar way the engineer is armed and fortified.

What is most needed in public life is a body of officials, sufficiently remunerated to permit of the selection of the most competent, and so protected that they may feel their continuance in the service to be permanent as long as their conduct be good. The miserable salaries allowed to engineers in public life and the almost certainty of subjection to unfair and bitter criticism have served to frighten off many worthy men and have made of the service a roosting place for the aged and the weaklings. The civil service acts in force do not materially better this, for protection afforded is seldom sought except by the incompetent in time of stress. Politicians are too shrewd to allow themselves to meddle in technical matters and realize thoroughly that a corps of trained technical assistants cannot be collected by favors. Once in the service, it is difficult under present conditions to dislodge an incompetent, unless he commit some particularly flagrant act, which calls for summary treatment. And so in large measure such acts are a positive hindrance to an official who is endeavoring to secure the best results for his employer. In this I can speak feelingly and with some intimate knowledge, since I have had occasion in the government service to test the strength of the civil service act, by seeking to remove incompetent and dishonest employes. It is my experience that little short of a proof of murder will serve as a reason for discharge of a worthless servant, and that in most cases the official making the charges must first prove his innocence. Unless we are able to attract to the public service by generous treatment, both in the way of salary and a larger measure of authority and control of works, it is hopeless to look for much improved conditions by regulation. In the majority of cases the engineer stands towards the governing body in the position of genteel messenger boy, and following correction of this condition must come any real betterment of the methods in vogue in the letting and enforcement of contracts. It is, however, a matter of surprise to me that an officer of the engineer corps, which is least affected by restraint of any class of engineers, should make a serious proposal to further reduce the activity of the profession as he has done.

ROBERT G. DIECK, C. E.,
Portland, Oregon.

Best Pavement for Steep Grade.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I note in your issue of March last an inquiry as to the best material for a street improvement from a safety point of view with a grade of ten per cent. Perhaps our experience in Yonkers, which is a very hilly city, may help answer this inquiry.

We have tried all the standard pavements except wood, and we find that granite is too slippery for grades over 8 per cent. We use macadam on most of our hilly streets, but we have had very satisfactory results with bitulithic on grades up to 11 per cent. One street paved with bitulithic on this grade is now ten years old and in good order. The only thing that has been done to it since it was laid, was to cover with coarse screenings the first year or two where the bitumen showed a tendency to work to the surface in very warm weather. For light traffic I consider this pavement excellent up to 10 per cent grades, and I know of none better.

S. L. COOPER, City Engineer.
Yonkers, N. Y.

A Rock Asphalt Street with Continuous Asphalt Surface.

The Neuchatel Asphalt Company, of New York, supplies the following information regarding the rock asphalt street on Thomas street, New York City, some description of which appeared in the July number of MUNICIPAL ENGINEERING, vol. xli, p. 70.

The asphalt used is mined in Travers, a province of Neuchatel, Switzerland. In pavement construction, such as was laid on Thomas street, the asphalt is mixed with a quantity of sand and molded into blocks 10 by 10 by 1¾ inches. A 4 or 5-inch concrete base is laid and upon this is spread a layer of sand and cement mixed dry. The blocks are then laid upon this and flushed with water, which runs between the interstices and wets the sand and cement layer. After a short time a layer of Neuchatel asphalt, mixed with a quantity of flux sufficient to give it a rubbery consistency, is spread over the entire surface to a depth of from ¼ to ½ inch. This layer forms the wearing surface.

There is a short alley about 150 feet long adjoining Thomas street which has been in use under heavy teaming for about eight years. Except for occasional patching this pavement has needed no attention. The patching was only necessary in the surface coat of asphaltic rubber. The pavement resembles asphalt in appearance but is more resilient and shows the hoof marks a little more plainly. In spots where the surface coat has worn off (there were only one or two on the 8-year-old alley) the blocks beneath show little or no wear. The cost, $4.25 per square yard, is rather high, except for such special uses as bridge floors, garage and fire house floors, etc.

A bridge on Riverside Drive in New York City has been in use for fifteen years, and the Eighth street viaduct in Cincinnati has also been used for a number of years.

A Concrete Pavement with Bituminous Wearing Surface.

To the Editor of MUNICIPAL ENGINEERING:

Sir—During the past few years a distinctly new type of pavement, consisting of a properly constructed concrete base and a thin wearing surface of bitumen and sand, has been developed and extensively used on the main streets at Ann Arbor, Mich., and to a somewhat more limited extent in other cities and towns.

About four years ago, in order to prolong the life of the asphalt block pavements, which at that time showed considerable wear, Mr. E. W. Graves, city engineer at Ann Arbor, as an experiment tried covering the surface of the pavement with a thin coating of coal tar and sand. After being subjected to various conditions of traffic for two years, this thin wearing surface proved to be so satisfactory that Mr. Graves determined to try it for new construction work on a concrete base. During the summer of 1909 one block on a residence street was paved with concrete having a coal tar and sand wearing surface. In 1910 approximately 18,000 square yards of this pavement were laid, the same type of construction having been adopted for an additional 63,000 square yards on nine main streets and alleys. This year there will be laid in the neighborhood of 100,000 square yards, petitions having been received for a greater yardage than it will be possible to construct.

Ann Arbor has a well-drained, somewhat sandy sub-soil, and the concrete pavement is laid directly upon the sub-grade without using a sub-base, which would be necessary where a heavy, wet, poorly-drained sub-soil is encountered. The concrete pavement proper consists of a 4½-inch gravel concrete base and a 1½-inch wearing surface, mixed one part cement to two parts clean, coarse sand. The concrete is laid in strips one-half the width of the street wide and 25 feet long, an expansion joint from ¾ inch to 1 inch in width being placed every 25 feet across the street perpendicular to the axis and at each curb.

The surface of the concrete is given a wood-float finish and slightly roughened by brushing with an ordinary hand street broom. After finishing a section as described, the form at the center or crown of the street is removed, and the pavement for the other half of the street is laid, the new concrete being deposited against that which has been previously placed, so that while there is a joint at the crown of the street it is hardly perceptible. This joint would be decidedly objectionable were it not protected by the wearing surface of bitumen and sand that is later applied, and may be eliminated by laying the pavement in sections extending across the full width of the street. This is possible and has been successfully done where concrete pavements have been laid on streets wider than those at Ann Arbor.

After the concrete has hardened the surface is covered with hot bitumen applied with a sprinkler wagon designed for the purpose, having a firebox under the tank to heat the material. The bitumen is immediately distributed evenly over the surface of the concrete by brushing with an ordinary street-sweeping broom, and the surface is then covered with sand. Approximately one-half gallon of bitumen is applied per square yard of surface, and a cubic yard of sand will cover about 30 square yards, making the wearing surface from ¼ to ⅜ inch thick. For the first pavement laid Mr. Graves used ordinary coal tar obtained from the local gas works. Later on he tried distilled tar and considered that this was more satisfactory than the crude tar. This year he has used "tarvia," has experimented with asphalt and a specially prepared bitumen known as "Dolarway."

The work at Ann Arbor is done by the city, which has its own equipment, purchases material and hires the labor. In 1910, with

common labor at $1.75 to $2.00 per day, cement from $1.07 to $1.32 per barrel asd gravel at 75 cents per cubic yard on the street, the cost of a 6-inch concrete pavement and wearing surface of bitumen and sand has varied from 71 cents to 88 cents per square yard; the total cost, including light grading and a 6 by 8 by 14-inch curb on each side of the street, varied from 94 cents to $1.16 per square yard of pavement on streets 30 and 34 feet wide. With "tarvia" at 8 cents per gallon and sand at 75 cents per cubic yard the cost of materials and labor for the wearing surface has been approximately 5 cents per square yard. These figures are for the actual cost of construction with materials and labor as given.

The materials required for the construction of this pavement are to be found or easily obtained in all localities, and the equipment necessary, besides the usual tools owned by every contractor, consists simply of a suitable concrete mixer, a tank wagon for sprinkling bitumen, an ordinary street sweeper and a wagon provided with a sand spreader.

The concrete pavements at Ann Arbor have been subjected for the past two years to all conditions of traffic of a city of 15,000. Kansas City has a small stretch of similar pavement on Sixth street, which has been exposed since last fall to the heaviest traffic in the city, and is today in first-class condition. Based upon the results obtained in these two cities, this type of construction is to be considered as suitable for paving residence streets, alleys, courts and squares, country roads and highways. It is said to meet the demand for a low-cost, durable pavement, approximately in first cost that of an ordinary macadam road and in durability that of our better types of street pavements.

UNIVERSAL PORTLAND CEMENT CO.,
Chicago, Ill.

A New Portland Cement Plant.

To the Editor of MUNICIPAL ENGINEERING:

Sir—On August 15 the Tidewater Portland Cement Company formally opened its large Portland cement plant at Union Bridge, Md. Governor John K. Tener, of Pennsylvania, was present and threw in the switch that put in operation the machinery of the new plant. A special train brought a large number of guests from Baltimore, New York, Pittsburgh and other points to witness the inauguration of the new enterprise, which is one of the largest in Maryland.

The plant of the Tidewater Portland Cement Company is located at Union Bridge, Md., 45 miles from Baltimore, on the line of the Western Maryland railroad. It is exceptionally well situated, as it commands both the markets of Baltimore and Washington, and is also near enough to tidewater to reach most of the Atlantic seaboard cities at a low freight cost. The plant has a capacity of 1,000,000 barrels of Portland cement and 25,000 tons of hydrated lime annually. In addition to the above the Tidewater Cement Company will manufacture a water-proof cement, and also white Portland cement.

The hydrated lime plant has been in operation for about a year and its product is now well known in its territory.

The raw materials at Union Bridge consist of an unusually pure limestone, resembling marble in appearance, and a volcanic shale. These two materials are found side by side within a hundred yards of the mill, and the deposits are practically inexhaustible.

The power plant of the Tidewater Portland Cement Company is equipped with Rust vertical boilers, which are fed by Roney stokers, and with Wisconsin engines directly connected to General Electric Company's generators. All the machinery throughout the mill is electrically driven. Even the elevators and conveyors have their separate motors. All three grinding plants, raw mill, coal mill and clinker mill, are equipped with Fuller-Lehigh mills. The kilns are 8x125 feet each and were made by the Vulcan Iron Company. The dryers and coolers were also made by this firm. The dryers are three in number, one for shale and two for limestone, and are arranged so as to take the waste heat from the kilns, making hand-firing unnecessary, and so saving fuel. Each kiln is provided with its own cooler, and these latter are placed below the kilns so that the air for combustion must pass through them, and thus become pre-heated by the hot clinker discharged from the kiln.

The crushers are four in number. One No. 8 and two No. 6's are used for limestone, while the other No. 6 is used for shale. The No. 8 crusher is arranged to discharge directly into the No. 6. The stone is handled by means of pan conveyors. The coal for both burning and power is discharged from a trestle onto a pile, beneath which runs a tunnel, and in this tunnel a belt conveyor. There is also a large clinker storage. The storehouse will hold 80,000 barrels and is equipped with self-emptying bins and Bates valve packers. Avery automatic scales are used throughout the plant, both for mixing and recording.

The officers of the company are: John K. Tener, president; J. T. Fanning, vice-president; B. T. Scott, vice-president; Owen B. Murphy, secretary and treasurer; Richard K. Meade, general manager; R. N. Soper, sales manager; J. Dreisbach, superintendent; Dr. E. A. Slagle, chemist.

RICHARD K. MEADE,
General Manager, Baltimore, Md.

MUNICIPAL MATTERS IN COURT

Higher Courts—The Laporte, Ind., Water Works Case.

Decisions of the Higher Courts of Interest to Municipalities.

Contract Not Legal Unless the Advertisement for Bids is Regular.—The city's proposals for bids for construction of a sewage disposal plant, which, under Greater New York Charter and regulations established thereunder, were required to state the nature and extent, as near as possible, of the work required, were not sufficient to furnish the basis for bids, so as to authorize a contract thereon; they in effect allowing any method of sewage disposal and arrangement of appurtenances according to any system, and according to plans and specifications to be submitted with a bid.—Hart v. City of New York (N. Y.), 94 N. E. 219.

Different Bonding Questions Must Be Submitted Separately.—Where municipal authorities desired to enter into a contract whereby the other contracting party should supply water for the term of 20 years to the city and its citizens, the municipality to agree to pay for the water used by it at a certain rate for the term mentioned, and whereby the other contracting party was to furnish to the city electric light for the same period, and the city was to pay therefor at a certain rate per annum, and the other party was also to agree to build and operate a street railroad in the city, and where the entire contract was submitted to the voters to be voted on at one time, without any opportunity to vote on the different propositions separately, such submission was illegal.—Americus Ry. & Light Co. et al. v. Mayor, etc., of City of Americus (Ga.), 70 S. 578.

Right of Water Company to Instal Meters on Free Water Service.—The contract between a city and a water supply company permitted the city to maintain service pipes from the mains to obtain water for its public uses, but required the connections to be made under the supervision of the water company, and provided that whatever water was furnished for the city's public uses should be used under reasonable regulations prescribed by the water company, and that water from the city's service pipes should be used only fo rpublic purposes and without waste. The water company refused to permit the city to connect its service pipes to procure water for its sewerage system, unless meters were installed at the expense of the water company. It appeared that the meter systm was the only practicable way of determining whether there was unnecessary waste in flushing them. *Held*, that the water company had the right to require the installation of meters at its own expense as a condition to making the connection, though the city paid a flat rate for water it used; the fact that it might be necessary to place the meters in boxes located near the curbs not constituting such an obstruction as to make the water company's demand unreasonable.—Portsmouth, Berkley & Suffolk Water Co. v. City of Portsmouth (Va.), 70 S. E. 529.

City Not Liable for Injury from Fireworks Set Off Under Authority.—The setting off of fireworks by a municipality, which holds ground for the public as a playground, solely for the public use, is not a nuisance, as the town is not the owner of the playground in the ordinary sense; and, furthermore, the setting off of fireworks on a single occasion does not create any permanent or continuing condition of real estate, and ordinary negligence is not a nuisance. A municipality is not liable for injuries by fireworks set off under statutory authority on a public playground, as it is a public work, conducted solely in the public interest and for the general benefit.—Kerr v. Inhabitants of Brookline (Mass.), 94 N. E. 257.

Liability for Negligence in Sewer Construction—A city authorized to build sewers is not liable for injuries to the property of an individual caused by the construction of the sewer, unless it or its contractor is guilty of negligence, or there is an actual physical invasion of the property. A contractor employed by a city to construct a sewer as authorized by statute and performing the work under the supervision of the city, occupies the position of the city, and is not liable for injuries to the property of an individual in consequence of the construction of the sewer, in the absence of any negligence or an actual physical invasion of the property. A municipal corporation has no greater immunity than a private corporation or person from the consequence of its own negligent or unskillful performance of a lawful work. A city employing a contractor to perform a

lawful work under its supervision or employing an independent contractor is liable for the negligence of the contractor in the performance of his work.—Hanrahan v. Mayor and City Council of Baltimore et al. (Md.) 80 Atl., 312.

Unreasonable Delay in Paving Contract Invalidates Tax Bills.—Where an ordinance for street paving allowed a reasonable time for the performance of the work, the city engineer could not grant extensions, delaying the completion of the improvement beyond a reasonable time. A contract for street paving contemplated that the work should begin in November, and evidence showed that under favorable conditions the work could be completed in a month. No work was done by the contractor until late in April following. There was a continuous period of about three weeks in December in which work might have been performed, and there were other shorter periods during the winter and early in the spring. Held to show as a matter of law a want of reasonable diligence on the part of the contractor, rendering the tax bills invalid on that ground.—Gilsonite Const. Co. v. Field et al. (Mo.) 138 S. W., 676.

Private Sewer Not Ground for Vacating Assessment for Public Sewer.—A landowner who has a private sewer cannot vacate an assessment for a public sewer when benefited thereby because the public sewer did not adopt his own.—Lehigh Valley R. R. Co. et al. v. Mayor, etc., of Jersey City et al. (N. J.) 80 Atl., 228.

Trespass Does Not Invalidate Sewer Assessment.—Although a public sewer was run over private property and its establishment thereon was a trespass, that fact does not excuse a private landowner from special assessments for benefits received therefrom. —Id.

Cost of Repaving Street May Be Assessed. —The liability of abutting property owners to assessment for the improvement of a street is not limited to its original construction, but the cost of repaving, when necessary to keep the street in proper condition, may also be assessed against them as special benefits.—Citizens' Association v. City of Bridgeport. (Conn.) 80 Atl., 203.

Validity of Health Regulations—Bathing in Public Water Supply.—Though a riparian owner's right to the reasonable use of the water of a pond includes the right to bathe and swim therein, such right was not primary, but incidental to the ownership of the land, and hence a regulation of the State Board of Health prohibiting bathing in a pond from which a city derived its water supply was not unconstitutional as depriving a riparian proprietor of his property without compensation and without due process of law, but was a valid exercise of police power. A health regulation, in order to be valid as a proper exercise of police power, in some reasonable degree, must tend to accomplish the result sought, and hence the question of its validity is for the court, though the wisdom or expediency of the measure is for the enacting power. A regulation by the State Board of Health, prohibiting bathing in a pond from which the city obtained its water supply, is valid, though there are other sources of contamination more serious than bathing, which were not affected by the regulation. Regulations for the protection of health are looked on with favor, and every reasonable presumption and intendment is indulged with reference to each element essential to their constitutionality.—State v. Morse. (Vt.) 80 Atl., 189.

Sidewalk Ordinance Must Be Specific as to Necessary Appurtenant Construction.—An ordinance for the improvement of a certain street provided for concrete walks, and that the sidewalk space should be graded by cutting down or filling up the surface of the ground to 14 inches below grade, and that the necessary filling should be done with earth or other material. The ordinance also provided that abutting owners might construct the sidewalk in front of their property if the work complied with the requirements of the ordinance. The objector's property was 9 feet below grade, and in order to construct the sidewalk a retaining wall or an embankment would be necessary. Held, that as the ordinance did not specify how such retaining walls should be made, or of what materials, or whether an embankment should be used instead, the assessment for the improvement provided for in the ordinance was void.—City of Chicago v. Marsh et al. (Ill.) 95 N. E., 473.

Regulation of Street Railways by City Must Be Reasonable.—A city has the right, under police power, to regulate the use of the tracks and cars of a street railroad company in a reasonable manner. The right of a city, by the exercise of its police power, to regulate any business or the use of any property does not give the power to prohibit the conduct of a lawful business, or to entirely suppress the use of property. A city cannot, by mere declaration, show the operation of a street railroad constructed under authority of law to be a nuisance, and subject its tracks to removal, merely because its operation may be dangerous, since the public welfare declares that there should not be a discontinuance of the operation of an authorized railroad.—City of Chicago v. Chicago and Oak Park Elevated Railway Co. (Ill.) 95 N. E., 456.

Contract with City for Indefinite Period Can Be Voided by Later Council.—A council of a municipality cannot make a binding contract by which it undertakes to obligate the municipality to furnish "free of charge," for an indefinite time in the future, sufficient water for the closets in a given building situated within the corporate limits, in consideration of the owner of the building allowing the municipality to lay its sewers through his land. Such a contract, being

ultra vires and void, could not be ratified by the continued use, under the contract, of the sewer through the land by the municipality; nor would the benefit thereby received estop it from subsequently setting up the invalidity of the contract.—Hoskan v. City of Moultrie (Ga.), 71 S. E. 785.

Lands Must Be Appropriated by Ordinance, Not Resolution.—Under the act providing for the formation and establishment of towns, a resolution to pay awards for land damages, the effect of which is to vest the title to the lands to be taken in the municipality, is void in the absence of an ordinance providing for the laying out of the street for which it is necessary to take and appropriate the land. The statute grants to the municipality the power to open streets, and the appropriation of necessary lands; but the power must be exercised by ordinance, and not by a resolution.—Hening v. Town of Montclair et al. (N. J.), 80 Atl. 102.

What May Be Included in Sidewalk Contract.—In assessing for the construction of sidewalks on the principle of actual benefits, the front-foot rule is prima facie an equitable basis of assessment. When such sidewalk improvement involves the destruction of growing trees, and no provision of law exists for the award by the board of assessors to abutting owners of damages therefor, the fact that such damages are sustained will not justify the cancellation of an assessment for benefits for the construction of the sidewalk, even though such damages equal or exceed the benefits. An assessment for a sidewalk improvement, which includes the cost of grading and removal of trees, and divides it on the front-foot basis, instead of requiring the property in front of whch such grading and cutting was done to pay for it, was proper. Even if the grading of a street is a substantial improvement and not incidental to the construction of a sidewalk, under sections 64 and 71 of the town act, both may be included in one ordinance and one assessment.—Worth et al. v. Town of Westfield (N. J.), 80 Atl. 104.

Reconstruction of Bridge Is a Street Improvement.—Under an amendment to the Constitution providing that a city might increase its bonded indebtedness for the improvement of streets, the construction of a bridge in place of a previous bridge, which spanned a river, dividing a city street, is an "improvement" of the street, and bonded indebtedness may be incurred to pay for such improvement.—Bruce v. City Council of Greenville (S. C.), 71 S. C. 817.

Street Railway Company Cannot Retain Unused Tracks if They Constitute a Nuisance.—A railroad corporation, having the special privilege of constructing, maintaining and operating its railroad in the streets of a city, does not thereby acquire the right to maintain a nuisance in the streets, and it has no right to maintain a nuisance for the purpose of preserving a franchise. An adjudication requiring the removal of the rails would still leave the owners of the franchise free to replace the old rails with new, and to operate the railroad. If the claim of nuisance rested upon the mere nonuser of the franchise, a different question would be presented.—City of New York v. Montague et al., 129 N. Y. Supp. 1084.

The LaPorte, Ind., Water Works Case.

The United States Circuit Court of Appeals, Seventh district, has added its decision to those of other courts given in cases arising from the presumed attempt of the city of Laporte, Ind., to purchase a system of water works without the money to pay for it and under a limitation of indebtedness such that bonds could not be issued in sufficient amount to cover the entire cost.

The ordinance which began the proceedings attempted to bind the city to purchase a certain amount of stock in the company formed to build the works with the contractors and the city as the stockholders, and to purchase a definite amount of water per month at a fixed price sufficient to pay all expenses and gradually extinguish the bonds of the company issued to pay for the construction.

Water works had long been established by the city on the bank of Lily lake, within the city limits, and the entire supply for municipal uses and distribution to the inhabitants was drawn from that small body of water and contiguous small lakes; but this water was not potable, and for drinking purposes private wells were the only source of supply. Thus it was well recognized that public supply for domestic purposes from another source was needful, and upon petition of taxpayers the common council had submitted the question of an extension of the water works to that end, for vote by the electors, resulting in a majority favoring such undertaking. Thereupon plans were made and bids taken for extension of the works, but it turned out that the cost thereof, under the lowest bid, was beyond he ability of the city to incur as an indebtedness under the limitation fixed by the Constitution of Indiana. So the scheme involved in the present controversy was adopted.

The Laporte Water Supply Company was incorporated under the general statutes of Indiana—with the members of the firm which had made the lowest bid for the work as incorporators, vested with suitable powers for the undertaking and with $75,000 named as the capital stock, and the provisions of the ordinance were formally accepted by such corporation. It obtained title to the lands referred to outside the city limits for pumping station, wells and pipe line, and constructed the various works and pipe lines provided and intended by the ordinance, both on the above-mentioned lands and within the city, whereby connection with the municipal water works system was established. Thereupon the required supply of potable water was and is furnished for distribution by the city from and through its system. The buildings and machinery erected by the company within the city occupy lands owned by the city for the purposes of its water works, and the engines thereof are supplied with live steam from such works, in conformity with the provisions of the ordinance.

The ordinance was adopted August 7, 1899, for an extension of the water works, of which the cost was named at $97,850. At that date the city was otherwise indebted for an amount which left a margin slightly in excess of $30,000 for which it could occur indebtedness within the constitutional limita-

tion, and the inhibition was plain against contract liability for the cost of such extension. Another ordinance was adopted by the common council providing for an issue of municipal bonds to raise $30,000 to pay for like portion (300 shares) of the capital stock of the water company, and authorizing subscription on behalf of the city for such shares of stock. This fund was raised, paid over to the use of the company and 300 shares of stock were issued and received therefor. Wheeler & Co. (bidders for the work) entered into contract with the water supply company to make the extension provided under the ordinance for $30,000 in cash, $35,000 in stock, together with $60,000 in bonds to be issued by the company, secured by mortgage. Thereupon Wheeler & Co. received the amount paid by the city and the water supply company issued and delivered the mortgage and bonds referred to for use of Wheeler & Co. in performance of the work. These instruments were immediately marketed and the proceeds so used by Wheeler & Co., the bonds in suit being the unpaid portion thereof. The total number of shares of stock issued by the water supply company was 700, and Wheeler & Co. received 400 of such shares, making no cash payment for any part thereof, so that their only contribution to the capital stock was through their performance of the above mentioned construction contract.

Pending proceedings under these ordinances, and prior to the making of the construction contract or execution of the bonds and mortgage in suit, a suit was commenced by one Scott and other taxpayers of the city against both the city and the water supply company and the city officials to restrain issuance of bonds by either party and other proceedings thereunder. This suit resulted in a decree against such defendants.

After completion of the work Wheeler & Co. sold and transferred to the city of Laporte all of their shares of stock in the water supply company for $9,950. On May 2, 1900, "the city of Laporte entered into possession of the property of the water supply company and thenceforth operated it as a part of the water works system of the city." During such occupancy the city paid 12 of the outstanding mortgage bonds so issued by the water supply company, but ceased further payments thereof, when a decision in the above-mentioned Scott case was rendered on its appeal to the Supreme Court.

The property consists of a pumping station and appliances, wells and pipe line constructed by the water supply company on lands owned by the company, not within the city limits, and other works within the city of Laporte, constructed by the company on lands owned by the city for its water works, together with connecting pipe lines and appliances in intermediate highways of the city, for delivery of water from the wells of the company to the system of water works owned by the city, furnishing the inhabitants suitable drinking water, for which the existing supply of the city was unfit. These works were provided under and in conformity with the terms of a purported ordinance adopted by the common council to obtain such supplemental and needful supply of water.

The adverse propositions are as follows:

(1) That the ordinance referred to "was a mere sham, invented by the city officers and Wheeler & Co.," contractors for the work, "to hide the illegality of the transactions, and by indirection do what the laws and Constitution of Indiana prohibited," with "incorporation and use of the supply company" as a mere "dummy."

(2) That an adjudication accordingly, which appears in a suit commenced by taxpayers before the mortgage was made, is conclusive of such invalidity, as against the appellees.

(3) That "the machinery and appliances were put in as an enlargement and extension and as a part of the city water works plant, to be used and are in use by the city, and are not subject to be sold and torn out of the plant."

The mortgagor, Laporte Water Supply Company, is a corporation organized pursuant to the general laws of Indiana for the purposes named in its articles, which embrace the establishment and operation of a "water works system in and near the city of Laporte" and authority "to vend water to the city"; and its incorporation was plainly within the provisions of the statute referred to, conferring the usual powers to acquire, hold and convey corporate property. The contentions, therefore, of want of authority to construct and operate the works described in the decree, must rest on the alleged invalidity of the ordinances referred to and transactions thereunder, and not upon the further objection that the plant thus provided was "merely an extension and enlargement of the city's own water works system," and that the statutes "do not authorize a corporation to be created to operate as a part of" such systems.

The mortgage in suit, covering the plant so constructed, was executed by the water supply company, securing its negotiable bonds, which were marketed and the proceeds applied in performance of the construction contract; and the foreclosure decree involves only disposition of such property. Unless the facts in evidence disprove ownership of this property, in whole or in part, by the mortgagor company and establish ownership in the city of Laporte, as of the date when the mortgage was delivered, we believe the mortgagees to be entitled to the equitable relief awarded by the decree. For reversal, however, the appellant contends, in substance, that the ordinances and proceedings throughout were fraudulent means, devised and carried out between the common council and city officials, as one party, and Wheeler & Co. (bidders and contractors for the work), as the other party, to build the works for and on the credit of the city—in violation of the constitutional provision against incurring municipal indebtedness—with the water supply company incorporated and serving as a cloak or dummy for the city and having no actual interest in the undertaking, and that such fraud and invalidity are established, either (a) res adjudicata, in the case of Scott v. City of Laporte et al., or (b) under the undisputed circumstances in evidence. Thus the issue raised is not whether the ordinance provisions are enforceable against the city, nor whether the proceedings referred to were invalid in so far as they attempted to impose obligations upon the city, but it is limited to the inquiry whether contract relations and collusion between the parties to the undertaking are established, which affect and invalidate, in whole or in part, the mortgage of the plant, so issued by the water supply company.

The defense of res adjudicata rests on the decree obtained by Scott and other taxpayers in their suit against the city of Laporte and executive officials thereof and the water supply company, which was commenced August 26, 1899, after the adoption of the ordinance and before the water supply company let the contract for the work or made the mortgage involved in the present suit.

An application for an injunction pendente lite was denied, both classes of bonds were issued, and the work was completed. Subsequently the complaint was amended, stating further facts tending to show that the city was to become the owner of all the stock issued by the supply company, and a supplemental complaint was filed, charging that the arrangement was carried out, by issuance and sale of both classes of bonds and

by taking over by the city of the stock issued to Wheeler & Co., with the supply company serving as a cloak or dummy for the city to incur the mortgage indebtedness.

The judgment rendered on a second trial of the case declared:

It is therefore considered and adjudged that the ordinance of defendant city of August 7, 1899, referred to in the complaint and findings herein, is null and void; that the defendants, their officers, agents and servants, and each of them, be and are hereby severally, perpetually enjoined from paying or making any payments upon, or appropriating, demanding or receiving money for the payment of, the bonds or interest thereon of the Laporte Water Supply Company, described in the finding and being an issue of $65,000.00 par value, or the debt thereby attempted to be secured; and that said defendant city, its officers, agents and servants are hereby further perpetually enjoined from granting, giving or paying any money or thing of value to, or placing any of its funds at the disposal of, or paying any bills incurred, audited or authorized by the defendant Laporte Water Supply Company or its officers, agents or servants; and said defendant Laporte Water Supply Company, its officers, agents and servants are enjoined from in any manner making any demand upon the defendant city for money, property or thing of value whatsoever.

As the mortgage was issued by the water supply company after the litigation was commenced, the mortgagees were alike concluded thereby, under the common-law doctrine of lis pendens, unless their interest is exempt from such rule, either through the statutes of Indiana providing for lis pendens notice, or through the recognized exceptions from the rule at common law. This exemption is denied after detailed argument and citations.

The effect of invalidity of the ordinance under which the plant was constructed, in reference to the relief sought and granted against the mortgaged property, remains to be ascertained. The plant is unitary in respect of its construction and service, as an auxiliary means of water supply for the pre-existing water works system of the city. For the present consideration, however, it requires apportionment into two parts. The engines, structures and water pipes within the city are affixed to real estate either owned by the city or constituting highways thereof, with no property right in such real estate vested in the mortgagor company, otherwise than through the invalid ordinance. On the other hand, the wells, pumps, water pipes and other structures outside the city are located on lands purchased and held in the name of the mortgagor company, so that title to such portion does not rest on any grant or provision of the ordinance, although constructed and placed in conformity with its purposes.

1. In reference to the property within the city: The mortgager entered as a party to the collusive arrangement between the assumed representatives of the city and the bidders for the work, for adoption and acceptance of the ordinance, all having actual or presumptive knowledge of the facts which rendered such action on the part of the city officials both unauthorized and void. Therefore, neither the mortgagor nor the mortgagees chargeable with notice have equities in the premises to authorize the decree in their favor.

The insidious method which ultimately appears in the scheme for vesting in the city all property rights in the plant as an equity, through its ownership of all the capital stock, marks the entire transactions as violative of the constitutional provision, alike with various methods of direct conveyance to the municipality of such property, subject to a mortgage, which are thus condemned by the authorities above referred to. But assuming that the mortgagor, water supply company, incorporated between such parties to issue the stock and hold the property thereunder, thereby becomes a party, alike subject to condemnation and disability, its exclusive corporate ownership and possession of the real estate, wells and fixtures in question could not be disturbed and taken, either in law or equity, for the benefit of the city. Whatever may appear to be the present relation and status of the mortgagor in the premises, however, the mortgagees are entitled to foreclosure relief in respect thereof, as granted by the decree. While they are bound by the adjudication against the validity of the ordinance, as unconstitutional in its purpose, and are thus left without title or equity in the property within the city predicated thereon, their rights in the other portion do not rest in any sense upon the ordinance. The real estate was purchased from the several owners for the water supply company, and the title stands so vested in the mortgagor, with no right or interest possessed by the city, legal or equitable, apart from such rights as may be conferred by its purchase and ownership of the corporate stock; and the wells, pumps, pipe lines and other fixtures were provided and placed thereon by such owner of the fee. So the complete property right thus vested in the mortgagor was conveyed under the mortgage, and the recording acts protect the mortgagees from adverse claims, except to the extent of the lis pendens notice. Neither that notice nor the ultimate decree therein purports to set aside the title thus acquired, and no disturbance thereof was made by the decree, beyond its injunctional provisions against payment by or demand of the city on account of the bonds and mortgage, and other liabilities attempted to be imposed.

It is true that both portions of the works were provided in conformity with the purposes of the ordinance, to be united for an auxiliary water supply to the city system, and that each became useless for such object when severed, so that both depreciation of their value and loss to the city of such means of water supply must result from severance, while the city is forbidden to contract for purchase or use of that source of supply. The city cannot, directly or indirectly, be charged with liability to take and assume payment for works so provided by the unlawful scheme entered into between its officers and the contractors, but, without other equities than appear in the record, sequestration or other taking of this portion of the works from the mortgagees, for the benefit of the city, would be inequitable and unauthorized. The amount paid in by the city was within the constitutional limit, although the purpose was adjudged unlawful. If entitled, in any view, to be made an equitable lien or charge upon such portion, as against the mortgagor, it was not so made under the lis pendens, and the mortgagees (and bondholders) acquired the title without notice thereof otherwise. Therefore, the decree rightly grants foreclosure relief in respect of the property so held outside the city of Laporte.

Judge Baker dissents from the opinion of the court, believing that the water works plant is not separable into the two parts, and that the city should be left in possession of the entire property and should not be required, as the decision practically demands, to save the money which it has already paid into the scheme by purchasing at a price which it cannot fix, the portion outside the city limits.

FIRE AND WATER

The Value of Motor Fire Apparatus.*

BY LOUIS BEHRERS, CHIEF OF CHARLESTON, S. C., FIRE DEPARTMENT.

In discussing the use of motor fire apparatus I shall not dwell on the merits of any particular make, or the superiority of one design over another, but would suggest that only machines of sufficient horsepower, not less than ninety for fire engines and not less than sixty for combination wagons and chemical engines, be selected. The more horsepower a machine has, the more efficient work will it accomplish. There is no question that the motor engine has many advantages over the horse-drawn apparatus, and I wish to emphasize some of these advantages that occur to me as most worthy of consideration.

The first to be considered is the high speed of the motor apparatus in reaching fires. This is very important. Soon after Charleston's motor fire engine was commissioned came the first opportunity to test its speed efficiency and superiority under practical conditions. On the night of October 25, 1910, a one-story warehouse of the Atlantic Coast Line Railroad Company, a building of an area of 50x200 feet, with inflammable contents, took fire, the flames gaining considerable headway before the alarm was sent in, and being a mass of fire when the first apparatus arrived. Almost adjoining this shed, and distant by the width of a street, were the large freight depots, filled with cotton, hay and other combustible materials. In this street was also a box car loaded with cartridges and powder. The eaves of the depot were catching and the sides of the car were ablaze when I reached the scene simultaneously with the motor fire engine. This engine took the hydrant about fifty feet from the burning building, connections were made and the hose run out almost instantly. With the turn of the lever the motor was connected with its pump and two strong streams were soon playing on the igniting depot and burning car, which were saved by this promptness, for in three or four additional minutes, when the steam engines began to play, it would have been too late, and the property damage would have been very great.

The second advantage which comes to mind is the ability of the motor fire engine to answer any number of alarms coming in close succession. Whereas, with the horse-drawn apparatus, a succession of alarms is nothing short of a calamity. Two or three alarms in close succession impose a great strain upon engine horses, which are generally exhausted by the third call, and can not render adequate service.

A third striking advantage of the motor engine is its ability to throw water with almost no loss of time. On arriving at a fire it is ready for use, regardless of the distance traveled, whether long or short. The man who drives the motor is engineer and stoker as well. As soon as connections are made at the hydrant the motor is ready for pumping water under any pressure desired, and maintain a uniform stream for an indefinite period. Consequently, in a majority of instances, where there is a motor engine used with steamers, the motor machine will throw from 1,000 to 2,000 gallons of water on the fire before serviceable streams can be gotten from the steamers, and that supply of water will often hold in check most effectively a blaze until steam engines arrive with reinforcements.

The question naturally comes up, "What is the life of a motor fire engine?" It is not yet practically determined. But it may be fairly estimated. The average fire apparatus will travel approximately from 250 to 300 miles in a year in cities of about 60,000 population, or nearly 6,000 miles in twenty years; while the motor apparatus, not being taken out to "exercise" twice a week, travels from 120 to 150 miles a year. Not only that, but to estimate from a ten-year average of the steamer's fire pumping, I figure out that a motor fire engine will have to pump for only about ten hours per year, therefore, judging from the mileage and endurance of the touring car which I use in responding to alarms, inspecting buildings, visiting fire stations, etc., a car yet giving excellent service, which has traversed 4,500 miles in the past year, and fully 17,000 miles in the past four years, I see no reason, as the motor apparatus is constructed along lines for practical fire service, and is built much stronger than the average car used by chiefs, why the motor apparatus should not, with no more repairing than the ordinary steam apparatus, serve effectively for ten or fifteen years. This is an estimate which I make from practical observation.

The Charleston department has used a motor fire engine for over nine months with

*A paper before the South Carolina State Firemen's Association.

satisfactory results. This engine was built by the Webb Motor Fire Apparatus Company, and is a ninety-horsepower, six-cylinder Thomas motor machine, equipped with a rotary pump of a capacity of 800 gallons per minute at plug pressure; it carries a crew of eight men, 1,000 feet of hose, axes, ladders, extinguishers, pipes, etc., and has been in commission since October 1, 1910. It has not failed to respond to any fire, and has answered sixty-six alarms and traveled ninety-three miles, pumping at fires nine hours and fifty-one minutes. The cost to maintain this machine, for gasoline, cylinder oil, grease, spark plugs, recharging storage batteries, etc., has been $52.10, or 19 cents a day. The tires show no material wear, and have yet to experience their first blowout or puncture.

To accomplish this motor engine's work for nine months, using horses, would require four animals, which cost to maintain, for oats, hay, veterinary services, harness repairing and shoeing, about $15 per month per horse, a total of $540 for nine months. Coal for boiler would cost $15 per month, or $136 for nine months. This means a maintenance cost of $675 for the steamer. Comparison shows a saving to the city of Charleston of $622.70 in nine months in the use of the motor apparatus.

We also save the salaries of two drivers, one on the steam engine and one on the hose wagon, and of a stoker, at $65 per month each, or a total of $1,755 for nine months. Of the four engine and hose wagon horses, worth $300 apiece, one is lost by death, accident or unfitness for service every three or four years, making an additional cost of $100 per year. In comparison of totals for nine months' use of two types of apparatus there appears a balance in favor of the motor engine of $2,447.90 in nine months, or $3,303.72 in a year. Think of a saving like this in nine months, and you can not but agree with me that the motor apparatus is wonderfully economical. I have not in my comparison of maintenance cost included repair expenses for either apparatus, estimating that this item of upkeep will average about the same for each.

While the first cost of the self-propelled apparatus is greater than that of the horse-drawn equipment, the difference is made up in a short time after purchasing the motor engine by low maintenance and operating expense. Yet it appears to me that the economy of the motor engine is a minor argument in its favor, for, after all, it is efficiency we want, and I believe that you will all concede that quick action is the most essential feature in fire fighting, and when we take into consideration the fact that the motor apparatus will make a run in less than half the time required by the steam engine, then it is that its real value comes home to us.

With these advantages of the motor fire engine in view, not to mention others that could readily be cited, when we consider its facility for speedy response to alarms, its ability to respond to any number of alarms in close succession, its quick water-throwing power, and its capacity for long service, we can but feel compelled to advise the installation of one or more pieces of auto apparatus by every fire department.

I would advise cities planning to place motor apparatus in their fire departments to station this apparatus along with the horse-drawn equipment in the congested business districts, and have it respond to some of the calls from the outskirts as well. That method is the quickest and best way to try the auto engine out and to overcome any difficulties that experience might anticipate.

And now a word about the care of the motor engine. Proper lubrication is one of the most essential factors for good service. The very best lubricants should be used, care being taken that the engine oil contains as little carbon as possible, a result obtained principally by filtration. The transmission oils and grease for the running gear should be free from acid. Strained gasoline of the best quality should be used, for the cheaper grades produce carbon. The tires should be given the best of attention, and be kept properly inflated at all times, cuts being treated with cement preparation, as this adds to the life of the tires, which, when properly inflated, are less susceptible to punctures.

Driving a motor engine at a speed greater than twenty miles an hour through city streets does not pay, as the small amount of time saved by fast driving does not warrant the risk of accidents incurred. In regard to the men who handle the engine, I have found that it does not require experts. Any cool, sober man, with ordinary common sense, and with some knowledge of machinery, can learn to drive and operate a motor engine with the training of some two or three weeks.

In conclusion, I wish to say that I feel that Charleston is well pleased with the motor fire engine. As a matter of fact, I have recommended that our city order a motor combination chemical and hose wagon in the near future. But the motor apparatus has not reached its fullest development, as a matter of course. The motor fire engine pump, as constructed today, while giving excellent service and no trouble, can, I believe, and will be improved upon shortly, so that the water-throwing capacity of the motor engine will compare favorably with a first-size steamer. Manufacturers of fire apparatus in this country have been watching carefully the progress of the gasoline motor fire engine for the express purpose of introducing this type of apparatus into fire departments, and they will no doubt soon see that the pump is brought to its proper power. I would advise you not to discard steam engines, but to keep them all, and as soon as opportunity offers, to put in one or two pieces of motor apparatus, and give the auto engine type a fair trial, arriving at your own conclusions as to its value.

Proposed Interstate Roads.

Sidney Suggs, State Highway Commissioner of Oklahoma, is reported to be locating through his State a section of a continuous good road from Galveston, Tex., to Winnipeg, Man. The Oklahoma counties on the line have located their portions of it and will concentrate funds on its improvement. Winfield and Wichita, Kas., are on the proposed line, and county commissioners are raising money, Cowley county levying a one-mill tax, which will raise $49,000 a year. Texas counties are considering routes, but have not yet taken definite action.

A conference of prominent citizens and state officials of New York, Massachusetts and Connecticut, including a tour of inspection, is to be held with the idea of unifying the plans for roads of the three States so that they will connect with each other.

Highway Commissioner Bigelow of Pennsylvania proposes to build that State's section of the Lincoln Memorial road from Washington to Gettysburg at once, the surveys having already begun. The old National road from the Maryland line near Somerset to the West Virginia line near Wheeling will be built this year, some $300,000 or more to be spent ultimately upon this road.

The Georgia-Alabama Good Roads Association has been formed to promote a highway from Atlanta to Mobile, nearly all of which has been located. The road will connect with the Atlanta-Chattanooga road and the National road promoted by the Atlanta Journal and the New York Herald.

The "Florida Direct" highway has been located from Jacksonville, Fla., through Augusta, Ga., and Columbia, S. C., to Charlotte, N. C., where it connects with the National highway above mentioned. Strong efforts will be made to secure improvement by the local authorities of the portions of the line most needing it. The length of the road from Jacksonville to Charlotte is 463 miles. Signs will be placed on the route in November. A company has been formed to build a bridge over the Altamaha river.

Florida counties are improving their sections of the national highway above referred to, which was located some time since. Duval county has let a contract for 17 miles of sand-clay road on the line at an average of $1,070 a mile, with extras for clearing, grubbing and grading. Three and a quarter miles of the road near Jacksonville toward St. Augustine are being paved.

A map prepared by the Office of Public Roads merely for the purpose of gauging the extent of the good roads movement as fostered by individuals, associations and communities, shows the following great highways in contemplation or actually under construction:

From Yellowstone Park to Glacier National Park, through Fort Yellowstone, the Big Hole battlefield and other interesting points in the Rocky mountains—a total distance of 450 miles.

The Pacific highway from Vancouver, B. C., to Tijuana, Mexico, a distance of 2,009 miles.

The Memphis-to-Bristol highway, connecting Knoxville, Nashville and Jackson, a distance of 540 miles.

The Lincoln Memorial road, from Washington to Gettysburg, 40 miles.

The Sherman, Tex., to Galveston highway, 150 miles.

The Central highway, from Morehead City, N. C., on the Atlantic ocean, to Paint Rock, on the French Broad river, Tennessee, through Goldsboro, Raleigh, Greensboro, Salisbury, Charlotte and Asheville, N. C., 460 miles.

The Dupont highway, from the upper to the lower end of Delaware, proposed by T. Coleman Dupont, who has offered to advance $1,000,000 towards its construction; length of route, 103 miles.

The Des Moines-Kansas City and St. Joseph trail.

The Ocean-to-Ocean highway, extending from Cumberland, Md., to Tacoma, Wash., passing over the old Cumberland road, through Columbus, Indianapolis, St. Louis, over Boone's Lick trail, and St. Louis to Old Franklin, Mo., through Nebraska, Wyoming, Idaho, Oregon asd Washington; length of route, 3,800 miles.

The Montreal to Miami highway, passing through Albany, New York, Trenton, Philadelphia, Baltimore, Washington, Richmond, Raleigh, Columbia, Savannah and Jacksonville.

The Lincoln way, from Louisville to Nashville, 150 miles.

The Capital to Capital highway, extending from Washington, D. C., to Jacksonville, through the capitals of the seaboard States; length of route, 1,500 miles.

The Clay-Jefferson Memorial highway, from Niagara Falls to New Orleans, via Zanesville, Ohio; Maysville, Ky.; Nashville, Tenn., and Meridian, Miss.; 1,200 miles.

The "Red to Rio" highway, from Denison, Tex., to Dallas, Waco, Austin and San Antonio, connecting Houston and Galveston; 600 miles.

Another proposed Lincoln Memorial road would run from Washington to Richmond, Va., but has not yet received enthusiastic support.

St. Johns, Baker and Columbia counties are slowly getting their sections into passable shape.

STREET·LIGHTING

Manchester Gas—Milwaukee Gas.

Manchester, England, Municipal Gas Supply.

The annual working report of the Manchester municipal gas department has just been issued and records the fact that although the price charged for gas used in the city was the lowest ever imposed, the net result has been the highest profit on record.

The quantity of gas transmitted from the works showed an increase of 98,156,000 cubic feet, or 1.76 per cent., as compared with a decrease of 73,037,000 cubic feet, or 1.29 per cent., in the previous year. The number of gas consumers on March 31, 1911, within the city was 170,693, or 2,634 more than in the preceding year, while the number of consumers outside the city was 10,663, against 10,431 in 1910, the total increase for the year being 2,866.

The number of automatic meters in use at the end of the financial year was 63,663, as compared with 61,046 in the previous year, of which increase 2,473 have been placed in the city and 144 in the out townships. The quantity of gas passed by these meters was 590,062,000 cubic feet, an increase of 50,305,000 cubic feet over the previous year. These automatic meters were inspected once in every five weeks, and the amount collected from them during the year was $398,059. This amount is represented by 19,630,986 pennies (penny, 2 cents), weighing over 175 long tons.

The number of gas cookers owned and fixed by the gas department of the city was 53,730 on March 31, 1911, as compared with 49,948 for the year ended March 31, 1910. It is estimated that the quantity of gas consumed by these gas cookers in 1910 was 695,000,000 cubic feet, an increase of 39,000,000 feet over the previous year's figures. The gas department has also fixed 30,831 grillers in connection with the automatic and small ordinary meters. About 46 per cent. of the consumers now have the free use of a cooker or griller.

On March 31, last, the number of gas engines in use was 1,573, as compared with 1,613 in the previous year. The quantity of gas consumed by these engines was 380,994,000 cubic feet, an increase of 2,352,000 cubic feet.

In accordance with a resolution recently passed by the Manchester City Council the price charged for gas used within the city for manufacturing purposes only will be reduced from 55 cents to 49 cents per 1,000 cubic feet after June 25, 1911, provided the annual consumption is not less than 500,000 cubic feet. The quantity of gas supplied to automatic meters for 1 penny (2 cents) will be increased after September 30 from thirty to thirty-three cubic feet within the city and from twenty-five to twenty-eight cubic feet outside the city.

The gross profit on the year's working was $925,223, of which sum $225,008 was paid for interest on loans, leaving a net profit of $700,215. Of the latter amount the gas department paid over to the city fund for the relief of the city rates the sum of $226,292.

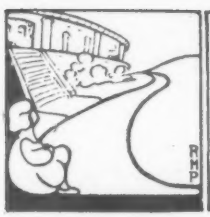
The total length of mains now laid is nearly 948.5 miles, an increase of almost 11 miles during the year. The number of public lamps within the city is 20,357, while outside there are 1,332. The incandescent system of lighting has been applied to all the lamps within the city, and the number of burners fixed thereto is 25,993.

High-pressure lighting has been installed in one of the sections of the city during the past year, and twenty-two lamps, each of 1,500 candlepower, have been fixed. This system of lighting is likely to be extended in the near future in the shopping quarters of the city.

Milwaukee Gas Rate Reduced.

Milwaukee gas consumers are said to be profiting to the extent of approximately $500 a day or $15,000 a month by new meter rates, involving a reduction from 80 to 75 cents per 1,000 cubic feet, according to officials of the company, who state that all bills rendered in August for July consumption of gas are being sent out under the new schedule.

The valuation of the company for taxing purposes was raised by the assessor from $6,000,000 to $10,750,000, and the company has successfully resisted an attempt to raise it another $3,000,000



ORGANIZATIONS & INDIVIDUALS

American Association for Highway Improvements—American Society for Municipal Improvements—League of American Municipalities—Technical Associations—Personal Notes.

American Association for Highway Improvement.

The first annual convention of the American Association for Highway Improvement will be held at Richmond, Va, November 20 to 24, 1911. The first meeting, at which President Taft will speak, will be held in the city auditorium, which has a capacity of 4,000 persons. Other meetings will be held in the auditorium of the Jefferson Hotel, 1,000 capacity.

The first day will be called National Day and in addition to President Taft's address there will be a number of speeches by railroad presidents and others of national prominence.

The second day will be Highway Engineers' Day. It will be given over to technical papers by men who lead their field in some specialty. Mr. Harold Parker of the Massachusetts Highway Commission will preside. Discussion of papers will be limited to five-minute speeches. Publication of papers and discussion will probably be made.

The third day will be Road Users' Day. It will be devoted to traffic regulations, national, state, county and city, and will deal with the question from the standpoint of all classes of traffic. Automobile regulations will be discussed.

The fourth day will be Association Day. The business meeting will be held, election of officers, etc. The affiliated organizations will be given a hearing.

The speakers include President Taft, President Logan Waller Page, Dr. Walter Page, President W. W. Finley of the Southern railway, Chairman B. F. Yokum, of the 'Frisco Lines, President W. C. Brown of the New York Central lines, Chairman Harold Parker of the Massachusetts Highway Commission, Gen. T. Coleman DuPont, Senators Martin and Swanson of Virginia, Congressman J Hampton Moore of Pennsylvania, the leading highway engineers of the country and others.

Among the organizations prominently identified are the Capital Highway Association, organized to build a highway from Washington to Atlanta; the Virginia, Indiana, Ohio, Tennessee, North Carolina and other state associations, etc.

The Touring Club of America is arranging tours from all of the larger cities. Special route cards, pennants, etc., will be furnished. The Capital Highway Association, Leonard Tufts, president, is arranging a tour from Atlanta to Richmond. G. A. Seward, chairman of the Canadian commission, and H. D. Hadley, chairman of the New York commission of the Quebec-Miami road project, are arranging a tour from Quebec via Montreal, Toronto, New York and Philadelphia, to concentrate with the eastern tour at Washington and proceed to Richmond. The southern tourists will meet at Atlanta and proceed to Richmond.

At a meeting held at the Hotel Belmont, New York, on August 17, and attended by representatives from forty road material and machinery manufacturers, the question of a machinery exhibition was discussed. They signified their willingness to provide exhbits if the association so desired in order to evidence their entire sympathy with the movement. President Page stated that the association would abide by the decision of the majority as to the advisability of an exposition, and it was unanimously decided not to provide a machinery exhibit. A resolution was adopted recognizing the association and a committee of six, with Secretary Pennybacker ex-officio, was appointed to work out a plan whereby the manufacturers may aid the association and evidence their support. It is probable that the manufacturers will hold a meeting in Richmond during the convention.

The Permanent International Association of Road Congresses, with headquarters at Paris, in which thirty-five governments are officially represented, has designated the association as its representative in the United States.

American Society of Municipal Improvements.

The annual convention of the American Society of Municipal Improvements will be held in Grand Rapids, Mich., September 26 to 29. The usual delay in announcing the program prevents publication in this number of the subjects to be discussed and the authors of papers.

The committee on standard specifications is active and has announced a meeting of the general committee and of the sub-com-

mittees on Monday, September 25, at 10 a. m., to which it is inviting the members of the corresponding committees of the Association for Standardizing Specifications with the purpose of furthering the expressed desire of members of that organization to attempt uniform reports to the two conventions. Others interested in the subject are also invited to be present at this preliminary meeting. Charles Carroll Brown, Indianapolis, Ind., is chairman of the general committee on standard specifications, having been appointed to fill the vacancy caused by the resignation of City Engineer Rust of Toronto to attend to his newly imposed duties as president of the Canadian Society of Civil Engineers.

Fred Giddings, Atchison, Kas., is the president of the American Society of Municipal Improvements and E. H. Christ is the vice-president representing the city of Grand Rapids, and in charge of the local arrangements.

The municipal officials among our readers who are not already members of this organization will find the convention well worth the time and money expended in attending it.

League of American Municipalities.

The fifteenth annual convention of the League of American Municipalities will be held at Atlanta, Ga., October 4, 5 and 6, 1911. Following is the preliminary program:

Address of welcome by Courtland S. Winn, Mayor of Atlanta.

Response and president's address by Darius A. Brown, president, and mayor of Kansas City, Mo.

"Long Time Bonds for City Improvements," by T. C. Thompson, mayor of Chattanooga, Tenn.

"Law Enforcement," by Marcus B. Cullum, mayor of Duluth, Minn.; Thomas Maloney, mayor of Council Bluffs, Iowa.

"Municipal Insurance Bonds," by Wilson J. Vance, secretary to the mayor, Newark, New Jersey.

"The Future City," by Samuel Carlson, mayor of Jamestown, N. Y.

"City Government by Commission," by Ford H. McGregor, Municipal Reference Bureau, the University of Wisconsin, Madison, Wis.

"The Board of Public Welfare of Kansas City, Mo.," by Jacob Billikopf, member of the Board of Public Works, Kansas City, Mo.

"What a Live City Can Do Under an Antiquated Charter," by J. C. Haynes, mayor of Minneapolis.

"Municipal Government, Its Needs and Requirements," by J. J. Keeley, alderman, Jackson, Mich.

"The Standardization of Municipal Business," by Fred H. Cosgrove, comptroller of Omaha, Neb.

An address by R. G. Rhett, mayor of Charleston, S. C.

John MacVicar, Des Moines, Iowa, is secretary.

Technical Associations.

The next meeting of the National Municipal League will be held in Richmond, Va., in November.

The St. Paul Association of Commerce is a combination of four organizations in various business promotion fields, made to eliminate duplication of efforts and concentrate upon the public work of the city. Joseph H. Beek, 237 Endicott building, St. Paul, Minn., is the general secretary.

State Highway Commissioner James R. Marker, of Ohio, reports that the United States Office of Public Roads made an exhibit of good roads construction at the State Fair in Columbus during the week of August 28 similar to that carried on the good roads train equipped by that office.

The Pacific Highway convention met in Portland, Ore., August 4 and 5. Governor Hay, of Washington, and Governor West, of Oregon, were prominent speakers.

The League of Wisconsin Municipalities held its annual convention in Superior the last week in July. Sewage disposal was discussed by Prof. Geo. J. Davis, of Madison; oiling streets, by City Engineer John F. Icke, of Madison, and there were other papers on general municipal subjects. The delegates inspected the water works plant of the Superior Water, Light and Power Company, and spent an afternoon visiting the industries of Duluth, Minn.

The National Conservation Congress to be held in Kansas City, Mo., September 25 to 27, promises to pay more attention to the engineering features of the work than have past congresses.

The American Association of Park Superintendents held its annual convention in Kansas City, Mo., August 8 to 10. Boston was chosen as the next place of meeting. W. H. Dunn, of Kansas City, was elected president and F. L. Mulford, of Washington, D. C., secretary.

The eleventh annual convention of the Union of Canadian Municipalities is held in Quebec, August 29 to 31. The principal subjects for discussion are town planning, special functions of a provincial capital, profitable destruction of garbage, conservation of water and water power, reinforced concrete water and sewer pipes, county roads and highways, need of expert experience in city government, each being divided into subtitles. W. D. Lighthall is secretary, Montreal, Can.

The International Municipal Congress and Exposition opens September 18 in the Coliseum and First Regiment Armory, Chicago, and continues for the remainder of the month.

The Illuminating Engineering Society is

to hold its annual convention in Chicago on September 25, 26 and 27. This society holds monthly section meetings in New York, Boston, Philadelphia and Chicago, and this is the first annual meeting to be held in the last named. About one-third of the membership is connected with the gas industry and the high order of the papers presented on this phase of lighting will undoubtedly be equaled if not surpassed at this meeting.

At the August meeting of the American Society of Engineer Draftsmen, New York, J. N. Mulder, of Amsterdam, Holland, read a paper on "Internal Combustion and Steam Engines." The society now has a grade of affiliate as a step toward full membership.

The Chicago Gas Rate.

The report of the committee appointed to investigate the cost of making gas in Chicago, reviewed at some length in "Editorial Comment," fixed upon 77 cents as a fair rate for gas, as shown by the data gathered for the period up to and including 1909.

The city council, however, believes that the rate should be still lower and has passed an ordinance fixing the maximum net rate at 75 cents for the first year, 70 cents for the second and third years and 68 cents for the fourth and fifth years covered by its provisions. The past rate has been 85 cents. The gas company asked the circuit court for a restraining order to prevent the enforcement of the new rate for the first year of 75 cents, which would have become effective August 10. This order the court granted, but also ordered the company to charge 80 cents for gas, this order to go into effect August 7. This rate was fixed by the judge and he refused to impound the 5 cents difference between this rate and the ordinance rate of 75 cents pending the decision of the case. Both city and company enter objections to the procedure of the judge, the latter because it reduces the rate and the former because it does not reduce it enough. Both deny the right of the judge to fix the rate at other than their figures until the case is finally decided.

Cost of Lighting Marietta, Ga., Increased.

The Georgia Railroad Commission has passed an order fixing a scale of prices to be charged by the Kenesaw Paper Company for lighting the streets of Marietta by the month.

The monthly rates fixed by the commission follow:

Arc lights	$5 60
Incandescent (60 candlepower)	2 00
Incandescent (32 candlepower)	1 00

The rate for the arc light is the same as charged by the company on yearly contracts. The rate for the 60 candlepower incandescent light is an increase of $1.00 per month, and that for 32 candlepower incandescent lights is an increase of 50 cents a month.

Personal Notes.

A. P. Hartman is chief engineer of the Bronx Valley sewer with offices in Yonkers, N. Y.

H. R. Safford has become chief engineer of the general contracting firm of George B. Swift Company.

Clarence Goldsmith is retained by Boston, Mass., on the new high pressure water service for fire protection.

Arthur M. Hood, Indianapolis, Ind., announces the association with him in the practice of patent law of George B. Schley.

H. E. Riggs, of Riggs and Sherman, Toledo, O., has been retained by Savannah, Ga., to make a valuation of the street railway system.

George Souers has been appointed superintendent of the water works plant at New Philadelphia, O., in place of N. W. Ramsey, resigned.

Albert T. Witbeck has resumed private practice in highway engineering at Brookhaven, Miss., having resigned his positon as county engneer.

E. G. Manahan and Thomas C. Atwood have been put in charge of the filtration plant to be constructed for treating the Croton water supply.

Ray Palmer will make tests for Mayor Harrison, of Chicago, Ill., to determine the best method of preventing damage to water pipes from electrolysis.

Fred D. Strong has been promoted division engineer of the fourth division, New York state highway department, succeeding F. W. San, who resigned on account of ill health.

Wm. Paul Gerhard, consulting hydraulic and sanitary engineer, New York City, has received the honorary degree of doctor of engineering from the Technical University of Darmstadt, Germany.

T. L. Holleran, of Indianapolis, Ind., has been added to the traveling force of the Troy Wagon Works Co., of Troy, O. Mr. Holleran is one of the best known men in the field as a superintendent of steam shovel work.

John Kenlon, acting chief, has been made chief of the Manhattan fire department to succeed Edward F. Croker, resigned. Mr. Kenlon's rank was highest in the civil service examinations, but differed very little from those of two others of the ten deputy chiefs who took the examination.

George L. Watson recently chief engineer of the United Paving Co. Atlantic City opens an office September 1, in the Land Title Building, Philadelphia, for practice as a consulting engineer for contractors on estimates and bids, and construction work generally.

Dr. C. O. Probst, for twenty-five years secretary and member of the Ohio state board of health, who has given that board the highest position in its field, has resigned, it is said, because he is no longer permtted to continue his excellent work in the lines which have proven so successful

The report of Arthur H. Blanchard, who represented the United States government at the recent Brussels Road Congress, has prepared a comprehensive report which contains information regarding his observations of European road practice. The report is at present in the hands of the printer.

Advertisements have been issued for the letting of the first of the roads to be constructed under the new Pennsylvania highway act. A complete reorganization of the department is being effected under the direction of Edward M. Bigelow, recently appointed commissioner of highways. A statement of the expenditure of the $5,000,000 appropriation, under the new law, is being prepared.

MACHINERY AND TRADE

Gas Producers and Gas Pumping Plants at Manchester, Mass.

The village of Manchester, Mass., has what is probably the most complete water supply system possessed by any town of its size in the country. This village is surrounded by many beautiful hills, on the tops of the highest of which some of the handsome residences of the neighborhood are located.

In order to supply the top floors of such houses with ample water pressure and to provide for the future erection of residences on the other hills, a radical change in the supply system of the village was decided upon, and about two years ago the old plant, which was many times taxed to the limit of its capacity, was replaced.

The old plant consisted of boilers and steam pumps, which forced the water from nearby driven wells to a standpipe located on a hill about 180 feet above the station. This furnished ample pressure for the lower sections of the town; but the second floors of the houses located on the higher hills could be assured of but an intermittent supply of water at the best. In addition to this, during the dry season, the wells were taxed to their utmost capacity, and it was evident that an additional source of water supply, as well as a pumping plant of greater capacity, would be necessary.

A small body of water known as Gravel Pond was selected as the source of new supply, and here the Gravel Pond pumping station was erected.

The equipment of the station consists of two Goulds' power pumps, double-acting triplex, 9x12 inches, each having a capacity of 1,000,000 gallons in 24 hours. Each pump is driven by a three-cylinder, four-cycle gas engine, developing 65 brake horsepower at 260 revolutions per minute. The gas for each engine is obtained from a suction producer, which uses either anthracite or bituminous coal.

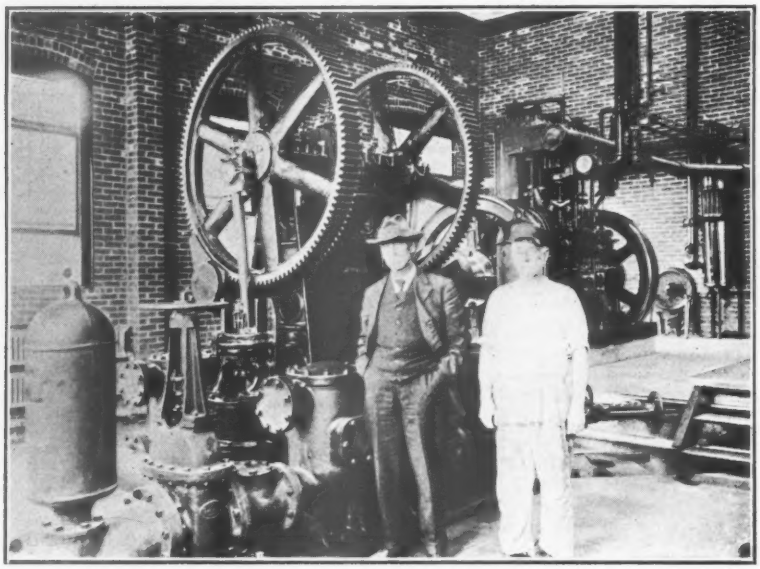
Full descriptions of the gas engines and the complete pumping plant will be found in MUNICIPAL ENGINEERING, vol. xxxix, p. 389, and vol. xl, p. 194.

Superintendent Andrews reports that during the year ending February 1, 1910, there have been pumped at the Gravel Pond station 60,578,000 gallons of water, with an attendant coal consumption of 58.485 tons. This approximates 1,035,700 gallons of water pumped per ton of coal. Although some of this water was pumped into the old standpipe against an average discharge head of 125 feet, the great majority of it was forced into the upper tank against an average discharge head about 75 feet greater, and it may be assumed that practically all of the pumping was done against this average 200-foot head. The daily records of the amount of water pumped are not reckoned from the number of revolutions made by the engines or pumps, but are taken directly from meters installed in the mains, and consequently whatever small amount of slip may be present is provided for, and only the actual number of gallons pumped enter into computation. Probably one of the most remarkable day's runs was that made August 18, 1910, when 330,000 gallons of water were pumped against a discharge head of 210 feet, with attendant coal consumption of 700 pounds. This averages nearly a million gallons per ton of coal, and as the suction lift represented about a 25-inch vacuum, the day's work was accomplished at an exceedingly high efficiency.

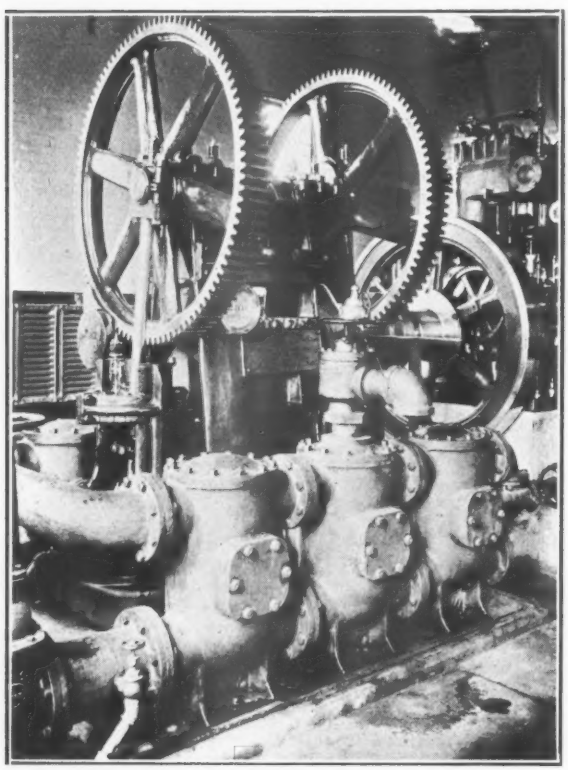
Mr. Raymond C. Allen, the supervising and consulting engineer of the water board, was confronted with rather an interesting problem in the design of this plant, but one which he successfully solved in a simple manner. The water used in the scrubbers of the producers for purifying the gas is rendered poisonous and unfit for consumption. The shores of the pond on which the station is situated are rather steep on all sides and form the watershed from which the supply is obtained. It was necessary, then, to construct a small receiving reservoir on the other side of the watershed, from which the water from the scrubbers could be piped. This was done and the poisonous water is now forced over to the other side of the shed by means of a small Goulds pump, located in a pit near the engine base. In consequence of this precaution the water from Gravel Pond is as pure and clear as though it sprung from an artesian well and is much softer than that formerly obtained from the old station.

A New Motor Drive for Fire Apparatus.

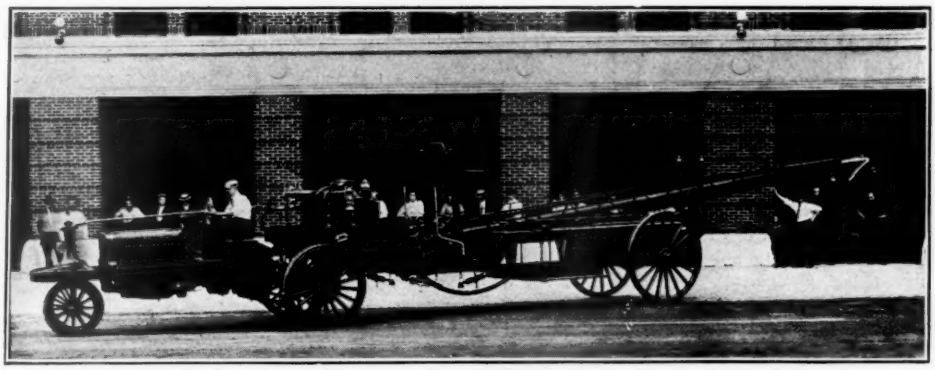
A novel vehicle has just made its appearance on the streets of Springfield, Mass., which creates as much excitement as did the first horseless carriage some years ago. It



GRAVEL POND PUMPING STATION, MANCHESTER, MASS.
1,000,000 Gallon Gould Pump Driven by Nash Gas Engine.



HOME PUMPING STATION, MANCHESTER, MASS.
750,000 Gallon Gould Pump.



THE MARTIN TRACTOR ATTACHED TO SPRINGFIELD, MASS., WATER TOWER.

consists of a piece of fire-fighting apparatus, known as a water tower, with a motor attachment in front, to take the place of horses. This is the latest product of the Knox automobile factory, and was built for the fire department of Springfield. It was invented and designed by Charles H. Martin, a well-known authority on matters pertaining to motor haulage.

The device consists of a steel frame, carrying a motor and transmission machinery, which is placed in front of a fire engine or other apparatus designed to be horse-drawn. It rests on the front axle of the vehicle to which it is attached. In front it is supported by a single wheel or two wheels placed close together. This construction gives it a more or less freaky appearance, but is said to be necessary in order to make short turns and to handle the vehicle in narrow streets.

The frame is supported on easy springs in both front and rear, which prevents the engine and drawing mechanism from being shaken to pieces on rough roads. The engine is geared by means of chains and sprockets to the front wheels of the vehicle, the whole making a complete motor-drawn piece of fire-fighting apparatus.

This device is as well adapted to all kinds of heavy trucking as it is to fire apparatus.

Mr. Martin is very enthusiastic about his invention. In describing it he said:

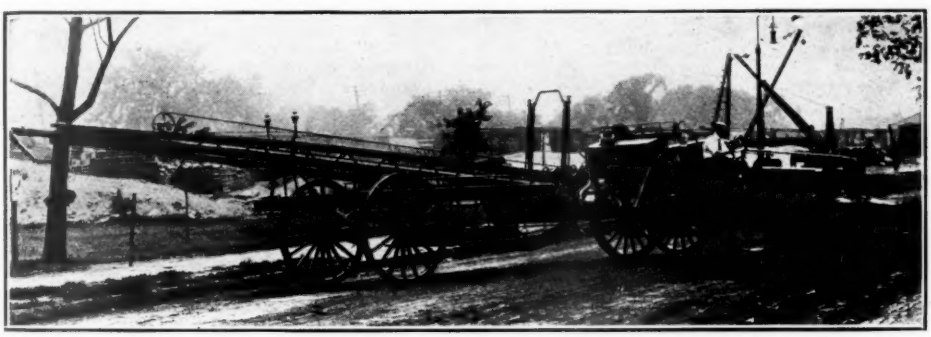
My tractor eliminates half the complications of ordinary motor truck construction, it cuts the expense of building and of upkeep in half, and at the same time it increases efficiency.

It proved out in practice all it promised in theory, and that is all we could ask. We are more than pleased with the tests. We carried 18,000 pounds up an 8 per cent. grade on a muddy road surface with only 21 per cent. of the total load on the driving wheels, which were fitted with special traction tread steel tires. There was not the slightest slippage, nor could we make the wheels skid on the wet asphalt, proving conclusively that it is possible to obtain traction with a steel tire.

We then drove over curbs, through plowed fields, through sand banks, maneuvered through the woods and did stunts which would be impossible with ordinary motor truck construction. We described a complete half-circle with the frame and the vehicle moved forward one foot, showing that we could drive through the differential and handle the vehicle just as we would with a pair of horses.

Every city in the country has several ladders, steam fire engines and other horse-drawn apparatus of proven worth which does not lend itself to ordinary automobile construction, that by the use of Martin's device can become motor driven and thus increase its usefulness 100 per cent.

The Knox Company will manufacture the appliance under Martin's patents, and the marketing will be done by a sales company, which Mr. Martin is at present organizing.



THE MARTIN TRACTOR TURNING AROUND IN A THIRTY FOOT STREET WITH ROOM TO SPARE.

Laying Brick with the Mathews Gravity Carrier.

There seems to be no field of modern endeavor where the inventive genius has not found an opening for the introduction of labor-saving appliances. Thousands of ideas have had their ultimate fruition in mere junk, while countless aspirants for fame and riches have wasted their lives in pursuit of a mechanical chimera. Many inventors have centered their attention upon producing freaks of mechanical construction, the work performed and the saving effected by their use not being compensatory for the investment and cost of operation and maintenance.

The greatest labor-saving machines are the embodiment of simple ideas worked out by simple mechanical methods. These are readily adopted by the public and yield large returns to the inventor or manufacturer.

LAYING PAVING BRICK. SHOWING METHOD OF USING MATHEWS GRAVITY CARRIER.

In the accompanying picture we illustrate one of the simple devices which accomplishes a simple task in a simple manner. It employes a force of nature, gravity, in operation. It consists of ball-bearing rollers set in a steel frame, the frame being coupled together and established on a slight grade. Such commodities as paving brick, tiling or other materials with comparatively smooth surface, will travel by their own weight any desired distance quickly and without injury.

The picture shows one of these gravity carriers set for conveying paving brick from the sidewalk pile to the bricklayers on the street. For such work the device has been found very efficient. It saves wheeling brick, the chipping from dumping, and the disturbance of the brick that have been laid by the wheeling and dumping. It also delivers the brick just where they are wanted by the layer so that they save him handling. As a time and labor saver it is a success, and thus pays for itself quickly.

The gravity carrier is very satisfactory for unloading brick from cars to wagon, especially if the wagon cannot be brought close to the car, for the frames can be set readily so that the brick in the car can be deposited at one end and taken off at the other in any convenient place for easy piling in the wagon.

The Mathews Gravity Carrier Co., St. Paul, Minn., who manufacture this device, have had very satisfactory success in placing them with contractors throughout the country. The following is a partial list of recent sales:

Hadway Bros., Olmstead Falls, Ohio; John Seels, Canton, Ohio; W. M. Pattison Supply Company, Cleveland, Ohio; Gould & Maybach, Painesville, Ohio; E. McShaffery & Son, Akron, Ohio; M. Ford, Cedar Rapids, Iowa; Patrick Reddington & Sons, Baltimore, Md.; Windsor Brothers, Akron, Ohio; J. T. Lynch, Circleville, Ohio; E. E. Morgan, Ravenna, Ohio; M. J. Beach, Baltimore, Md.; William Elder, Baltimore, Md.; H. P. Kniseley, Canton, Ohio; E. D. Bowen, Twinsburg, Ohio; A. J. Himes, Engineer N. Y. C. & St. L. R. R., Cleveland, Ohio; W. H. Vogt & Son, Beach City, Ohio; Messrs. Paul & Henry, Barberton, Ohio.

1. POURING G-K COMPOUND IN WATER COVERED JOINT.

A Flexible Water-Tight Sewer Joint.

To the Editor of MUICIPAL ENGINEERING:

Sir—Your department, "Workers in the Field," contains many articles of great interest to engineers and contractors and the extreme importance of water-tight sewers causes me to send you photos of joints made under conditions as shown and sworn to by Mr. G. W. Robbins, industrial photographer.

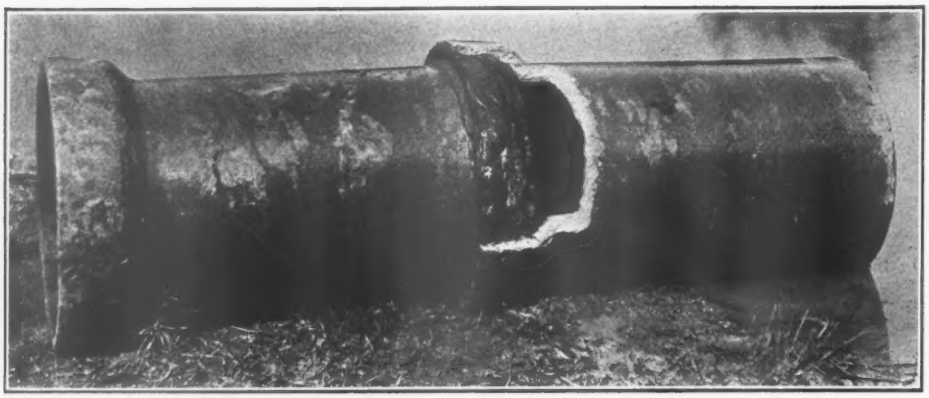
Photos Nos. 1 and 2 show photos of 12-inch tile jointed in water with the pipe nearly submerged, eliminating the necessity of pumping, the same joint taken up and showing the bottom of the joint and a section cut from same, showing the complete filling of the annular space with the G-K compound.

No. 3 represents three lengths of tile jointed in perfect alignment and after the compound had set and was cold was slowly deflected and tested to 15 pounds pressure without joint showing leak. An inspection of joint with reading glass will show the stretching of the compound, proving its flexibilty. Ths test is of great moment to the engineer and contractor, as it obviates the chance of broken tile from heavy backfill on soft subgrade.

No. 4 shows 2 lengths of 8-inch tile jointed with G-K and suspended from beam, bell end down, a hole drilled through the lower pipe, and, on a bar passed through, the aggregate weight of men on bar was 750 pounds.

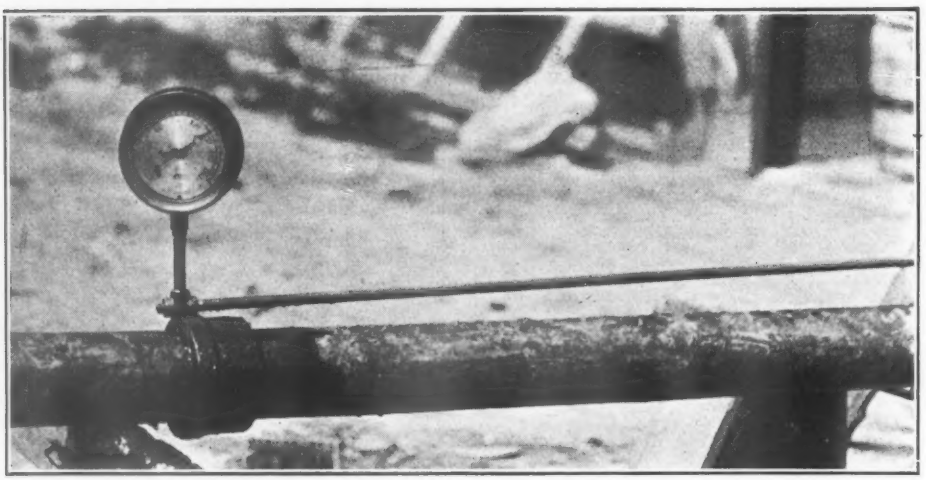
No. 5 shows cast iron pipe jointed with G-K and under pressure to 115 pounds. The

3. G-K COMPOUND JOINT UNDER TENSION.



2. CUT SEWER PIPE JOINT SHOWING FILLING WITH G-K COMPOUND.

4. SHOWING FLEXIBILITY OF WATER TIGHT JOINT MADE WITH G-K COMPOUND.



5. CAST IRON PIPE JOINT OF G-K COMPOUND UNDER 115 POUNDS PRESSURE.

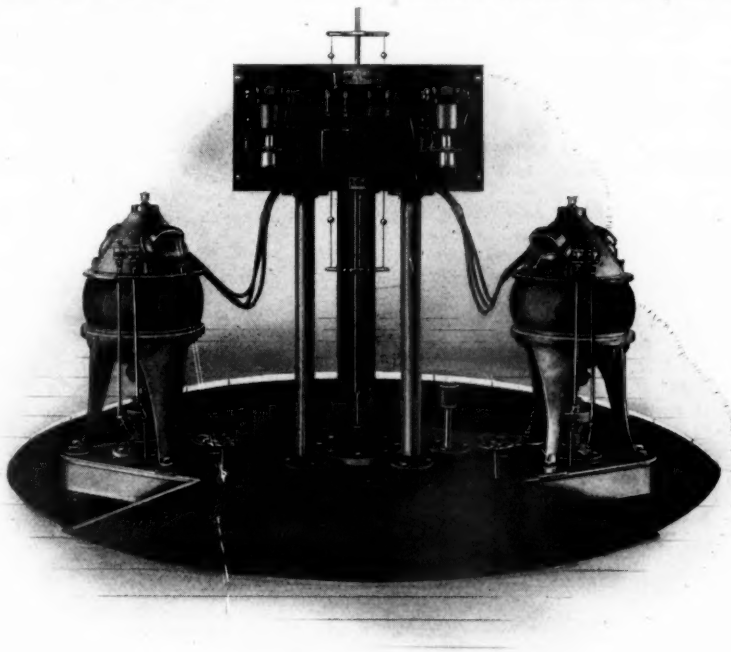
pressure was continued to 160 pounds, when the pipe burst. This test from an economic standpoint should be of great value to contractors laying iron water mains, as it is tight and bonded to the pipe for the complete depth, while a lead joint is only as tight as the perfect calking will make it, and then only for a depth of ¼ inch, rarely deeper, and the cost of the compound is only 1/7 that of lead, and where there is no calking or extra excavation the item of saving is very large. Its standing pressure test and the report of a prominent Canadian chemist that it is not acted upon by water or earth makes it an article that many engineers should give consideration. D.

Trade Publications.

The International Harvester Company has issued a booklet entitled "The Truth About the International Harvester Company," which purports to be an answer in full to the Townsend report, and was filed with the Stanley committee at Washington on August 12.

The Robeson Process Co., Au Sable Forks, N. Y., is publishing a series of "Roads Handbooks," one on "Dirt Roads" being a reprint of an article in MUNICIPAL ENGINEERING.

The Lehigh Portland Cement Co., Chicago, Ill., has published a new edition of DeWitt V. Moore's "Forty-One Concrete Reasons,"



FORM A, SUCTION TYPE, YEOMANS DUPLEX ELECTRIC SEWAGE EJECTOR INSTALLATION.

Electric Sewage Ejectors.

Yeomans Brothers, 1240 Monadnock block, Chicago, Ill., are manufacturers of electric pumps of various sorts, centrifugal, rotary and triplex, house pumps, bilge pumps and ejectors, as well as rotary air compressors. The centrifugal ejector is applied with success to sewage outlets or purification plants where pumping is necessary. As shown by the cut, it takes but small space and can be arranged with automatic control so that it can act intermittently, or either pump can operate alone if the other is out of order. A full description of the ejector will be found in MUNICIPAL ENGINEERING, Vol. xl, page 300, or can be obtained from catalog D, which will be sent upon request to the manufacturers.

which is fully illustrated and gives by pictures the evidence on which many of the reasons stated, are based. The first edition was 15,000 copies, and the demand for this second edition will be still greater. A copy can be had for the asking.

What quality in Lehigh Portland Cement means is shown by the statement in a small circular, that the company received an average of 23 cents a barrel premium on cement furnished on a government contract for which the specifications provided that a bonus of 5 cents a barrel would be paid for every ten pounds increase in tensile strength the cement showed over the specified 300 pounds per square inch in 28 days, briquettes being of 1 to 3 mortar.

Browning locomotive cranes is the sub-

ject of a new catalog of the Browning Engineering Co., Cleveland, O. The illustrations of the many uses to which the cranes are put are extremely interesting.

The Rockwell Furnace Co., New York, describe the Lalor automatic stop-valve for accident in bulletin 29.

Byerley & Sons, Cleveland, Ohio, manufacturers of Byerlyte asphalt, have just issued four very attractive and interesting booklets on asphalt and its various uses. These booklets are for free distribution and will be of great value to engineers, contractors and others interested in the use of asphalt in its many branches. Copies will be forwarded to those interested.

The American Steel Post Co., Los Angeles, Cal., have issued catalog 10 showing their lines of steel posts and poles, which have been designed along engineering lines and should be correspondingly satisfactory in service and economy.

Solon G. Howe, Detroit, Mich., has a sanitary catch basin which is readily cleaned and flushed, and concerning which he will send full information.

"Hydraulic Pumps, Catalog No. 81," is the title of a new 120 page 6x9 catalog, descriptive of many standard and several new types of hydraulic pumps. This catalog, issued and sent free by The Watson-Stillman Co., 50 Church street, New York, contains valuable information for hydraulic engineers and users of hydraulic machinery.

The August bulletin of the Lehigh Portland Cement Co., is devoted to a description of their new cement manufacturing plant at Mason City, Iowa, which is now ready for operation.

The latest Farm Cement News of the Universal Portland Cement Co., is largely devoted to concrete tanks, silos and cisterns.

Peoria Ornamental Lights.

The city of Peoria developed last spring an interest in ornamental lights and the Merchants' Association, after some investigation, decided upon the form of standard shown in the accompanying cut. At the request of the president of that organization the Peoria Gas and Electric Company purchased 65 of these "Corinthian" standards in May, and they have been set on Adams street, as noted elsewhere in this number of MUNICIPAL ENGINEERING.

The "Corinthian" standard, when equipped, requires a 100-watt tungsten lamp above and four 80-watt lamps in the lower level. This makes a current consumption of 2,500 kilowatts per year for the center lamp and about 5,000 kilowatts per year for the side lights. The city pays for the current and maintenance of the posts. The merchants paid the first cost of the posts, which were deeded to the city.

Among the numerous cities using these handsome standards are Wichita and Topeka, Kas.; Ottumwa and Oskaloosa, Iowa; Monmouth, Elgin, Pekin, Peoria, Ill.; Kingston, N. Y.; Knoxville, Tenn. They are made by the Flour City Ornamental Iron Works, Minneapolis, Minn.

THE CORINTHIAN STANDARD.

Trade Notes.

San Francisco, Cal.—The Steel City Electric Co., Pittsburg, Pa., have appointed the Aylesworth Agencies Co., San Francisco, Cal., their Pacific coast sales representatives.

Milwaukee, Wis.—The department of public works has authorized the purchase of equipment to utilize waste steam at the garbage incinerating plant for operating motors in the municipal water works system; $80,000. Harry E. Briggs, commissioner of public works.

San Francisco, Cal.—The Board of Public Works has been authorized to construct the Geary Street Municipal Railroad, $270,000. W. R. Hagerty, clerk.

Reading, Pa.—Contract has been awarded Allentown Portland Cement Co., for the Penn street bridge.

Laurel, Ind.—George McBarler, trustee Perry township, wants one road grading machine.

Council Bluffs, Iowa—Bids will received September 7 for furnishing 5,000 barrels of Portland cement in carload lots f. o. b. Council Bluffs. S. L. Etnyre, superintendent water works.

IMPROVEMENT AND CONTRACTING NEWS

RMP

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Little Rock, Ark.—Sept. 12, 2 p. m. Constructing a pike road. J. Evan Jones, auditor.

Stamford, Conn.—Sept. 5, 8 p. m. Constructing 6,500 square yards of brick pavement in Elm street. Harold A. Parsons, city engineer.

Jacksonville, Fla.—Sept. 5. Reconstructing 23,268 square yards of pavement in Bay street. Philip Prioleau, city engineer.

Lewiston, Idaho—Sept. 6. Constructing 19,000 square yards of hard surface pavement. C. F. Leland, city clerk.

Bloomfield, Ind.—Sept. 5, 10 a. m. Constructing macadam roads in Richland and Jackson townships. Caswell H. Jennings, auditor Greene county.

Bluffton, Ind.—Sept. 5, 10 a. m. Constructing stone roads in Lancaster, Jefferson and Chester townships. O. D. Garrett, auditor Wells county.

Brazil, Ind.—Sept. 6, 11:30 a. m. Constructing a gravel road in Brazil township. E. A. Staggs, auditor Clay county.

Corydon, Ind.—Sept. 5, 2 p. m. Constructing gravel roads in Webster and Boone townships. Wm. Taylor, auditor Harrison county.

Decatur, Ind.—September 4, 10 a. m. Constructng macadamized road in Monroe township. H. S. Michaud, auditor Adams county.

English, Ind.—Sept. 5, 2 p. m. Constructing a pike road. J. Evan Jones, auditor Crawford county.

Franklin, Ind.—Sept. 9, 2 p. m. Constructing ten gravel roads. Chas. F. Cromwell, auditor Clinton county.

Greenfield, Ind.—Sept. 15, 2 p. m. Constructing road on line between Hancock and Henry counties. C. H. Troy, auditor Hancock county.

Greensburg, Ind.—Sept. 4, 1 p. m. Constructing macadam road in Clinton township. Frank E. Ryan, auditor Decatur county.

Huntington, Ind.—Sept. 4, 10 a. m. Constructing highway in Dallas township. John W. Weaver, auditor Huntington county.

Indianapolis, Ind.—Sept. 6, 10 a. m. Improving Emerson avenue. C. A. Schrader, president board of public works.

Kentland, Ind.—Sept. 4, 1 p. m. Constructing macadam road in Jefferson township. E. R. Bringham, auditor Newton county.

Knox, Ind.—Sept. 5, 12 m. Constructing gravel roads in Oregon, Center, Wayne, North Bend and Washington townships. Lee M. Ransbottom, auditor Starke county.

Laporte, Ind.—Sept. 7, 10 a. m. Constructing macadamized road in Hanna township. F. A. Hausheer, auditor Laporte county.

Lebanon, Ind.—Sept. 11, 7:30 p. m. Constructing cement walk and curb in C street. Edmund Connor, city clerk.

Lebanon, Ind.—Sept. 4, 2 p. m. Constructing gravel road in Clinton township. B. F. Herdrich, auditor Boone county.

Logansport, Ind.—Sept. 5, 10 a. m. Constructing two macadam roads in Harrison township. J. E. Wallace, auditor Cass county.

Madison, Ind.—Sept. 5, 1 p. m. Constructing gravel road in Republican and Graham townships. Andrew M. Taff, auditor Jefferson county.

Marion, Ind.—Sept. 5. Constructing eight roads. J. A. Ridgway, secretary park board.

Monticello, Ind.—Sept. 6, 12 m. Constructing stone and gravel road in West Point, Prairie and Round Grove townships; also roads in Big Creek and Cass townships. A. G. Fisher, auditor White county.

Newport, Ind.—Sept. 7, 10 a. m. Constructing two gravel roads in Helt township. H. T. Payne, auditor Vermillion county.

Rushville, Ind.—Sept. 4, 2 p. m. Constructing macadam roads in Posey, Rushville, Noble and Jackson townships. Jesse M. Stone, auditor Rush county.

Salem, Ind.—Sept. 4, 1:30 p. m. Constructing road in Washington township. F. S. Munkelt, auditor Washington county.

Valparaiso, Ind.—Sept. 4, 10 a. m. Constructing two gravel roads. C. A. Blachly, auditor Porter county.

Vernon, Ind.—Sept. 4, 11 a. m. Constructing pike road in Spencer and Geneva township. M. V. Brogan, auditor Jennings county.

Vincennes, Ind.—Sept. 5. Constructing six gravel roads. John T. Scott, auditor Knox county.

Wabash, Ind.—Sept. 7, 10 a. m. Constructing highway in Chester township; also gravel road on line between Wabash and Kosciusko counties. J. P. Noftzger, auditor Wabash county.

Washington, Ind.—Sept. 5, 10 a. m. Constructing gravel roads in Elmore township. Thomas Nugent, auditor Daviess county.

Winamac, Ind.—Sept. 55, 12 m. Constructing three roads. W. E. Munchenberg, auditor Pulaski county.

Powson, Md.—Sept. 7, 12 m. Improving a section of Green Spring avenue, and grading a hill on Dogwood Road. Certified check, $100. Highways commission; Henry G. Shirley, county roads engineer.

Aberdeen, Miss.—Sept. 5, 2 p. m. Constructing various road improvement. W. H. Carlyle, secretary road commissioners, district No. 4.

Camden, N. J.—Sept. 7, 10:30 a. m. Constructing Gibbsboro and Berlin gravel road. J. J. Albertson, county engineer.

Huntington, N. Y.—Sept. 8, 11 a. m. Improving Main street. Certified check $500. Alonzo P. Whitson, town superintendent of highways.

Ashland, O.—Sept. 8, 1 p. m. Grading and macadamizing 1.6 miles of road under the state highway law, estimated at $9,547.12; also 1.04 miles, estimated at $6,320.54. Certified check, $300 with each bid. County commissioners. James R. Marker, state highway commissioner.

Columbus, O.—Sept. 15. Grading and macadamizing Jones road (1 mile); and constructing sidewalks on Broad street bridge. Commissioners of Franklin county.

Crooksville, O.—Sept. 9, 12 m. Grading, curbing, paving with brick, etc., in North Buckeye street. Certified check. Fred Cooke, village clerk.

Logan, O.—Sept. 4, 10 a. m. Grading and graveling 1.63 miles of road under the

state highway law. Estimate, $5,312. Certified check, $300. County commissioners; James R. Marker, state highway commissioner.

Maumee, O.—Sept. 2, 3 p. m. Constructing concrete tunnel on the premises of the Lucas county Children's Home. E. J. Brown, secretary. Bacon & Huber, Toledo, O., architects.

Millersburg, O.—Sept. 6, 1 p. m. Grading and macadamizing 1.4 miles of road under the state highway law. Estimate, $9,961.63. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

New Philadelphia, O.—Sept. 11, 1 p. m. Grading Oliver hill. Certified check, $50. W. C. Schott, county auditor.

Port Clinton, O.—Sept. 18, 12 m. Paving Fulton street. Certified check, $200. J. A. Singler, village clerk.

Sandusky, O.—Sept. 18. 1:30. Improving Darrow road in Berlin township. John Deitz, auditor Erie county.

Springfield, O.—Sept. 2, 10 a. m. Grading and macadamizing 2.2 miles of road under the state highway law. Estimate $15,255.-04. Certified check, $300; county commissioners. James R. Marker, Columbus, O., state highway commissioner.

Woodfield, O.—Sept. 2, 9 a. m. Grading and paving with brick 1.08 miles of road in Center township. Estimate $18,891.40. Certified check, $300. County commissioners. James R. Marker, state highway commissioner.

Muskogee, Okla.—Sept. 5, 10 a. m. Grading and paving certain alleys, street improvement district No. 133. Certified check, $500. Chas. Wheeler, Jr., city clerk.

Duquesne, Pa.—Sept. 2, 12 m. Grading, curbing and paving Oak street. L. W. Francis, chairman street committee.

East Brady, Pa.—Sept. 5, 8 p. m. Laying 70-feet of five-foot concrete walk. T. M. James, borough secretary.

Jeannette, Pa.—Sept. 4, 8 p. m. Constructing a retaining wall at Gaskill avenue and Harrison road. Certified check, $25. Borough council.

North Braddock, Pa.—Sept. 5, 3 p. m. Improving Coatmont and Anderson streets, and Earl and Ajax alleys. C. A. Stewart, borough engineer.

Pittsburg, Pa.—Sept 12, 10 a. m. Improving Emsworth and Haysville road, Steubenville pike, and Buena Vista and Greenock road in Allegheny county. Certified check with each bid. R. J. Cunningham, county controller.

Pittsburg, Pa.—Paving with brick in Washington avenue, Borough of Dormont. Certified check, $500. R. J. Cunningham, county controller.

Johnson City, Tenn.—Sept. 7, 7 p.m. Paving, constructing sewers, etc. P. F. McDonald, city commissioner.

Wheeling, W. Va.—Sept. 5, 9 a. m. Paving Top Mill road. Board of control.

West Allis, Wis.—Sept. 2. Macadamizing National avenue. Frank C. Douville, acting chairman board of public works.

CONTRACTS AWARDED.

Covina, Cal.—Improving streets, to Benjamin F. Ford, Covina, $28,332.

Long Beach, Cal.—Paving Sixteenth street, to White & Gaskill, Long Beach, $47,867.79; constructing sidewalks and curbs to McComb Bros., Los Angeles, $25,000.

Los Angeles, Cal.—Street improvement contracts: Barber Asphalt Co., $75,000; Fairchild-Gilmore-Wilton Co., $19,139; Withers & Crites, $8,873; George H. Oswald, $93,455; Los Angeles Investment Co., $55,-000; F. H. Potts, $10,000; L. H. McGowan; O. O. Farmer, $40,787.92; J. O. Stanford, $14,342.99.

San Francisco, Cal.—Constructing asphalt pavement in twenty-fifth street, to Flinn & Treacy, San Francisco; and in Greenwich street, to W. C. Raisch.

San Jose, Cal.—Improving Capitol avenue and Darryessa Road, to F. Wehner, $9,100.

Santa Barbara, Cal.—Paving four streets, to the Santa Barbara Paving Company.

Hartford, Conn.—Contracts for state road work: 1,707 lineal feet of macadam-telford, to the B. D. Pierce Jr., Co., Bridgeport; 1,840 lineal feet of telford macadam in Stamford to L. F. Merritt, Stamford; 3,449 lineal feet of macadam-telford in Windham, to A. Vito & Co., Thompson; 6.007 lineal feet of macadam-telford in Windsor, to the Pierson Engineering & Construction Co., Bristol; 7,606 lineal feet of macadam-telford in Granby, to A. Vito & Co.; 6,215 lineal feet of graded road in Cornwall, to the B. N. Beard Co., Shelton; 1,100 lineal feet of grading in Beacon Falls, to John De Michiel & Bro., Torrington; 8,515 lineal feet of gravel-telford to the B. N. Beard Co.

Naugatuck, Conn.—Constructing 3,100 square yards of brick pavement, to Field, Barker & Underwood, Philadelphia.

Waterbury, Conn.—Paving Meadow and Grand streets, to Field, Barker & Underwood, Inc., Philadelpha, $21,016..

Jacksonville, Fla.—Paving Panama Park Road, to the Engineering and Paving Co., Jacksonville, Fla.

Jacksonville, Fla.—Paving Sixty-fourth street, 4,260 lineal feet, to George R. Foster, Jacksonvile.

Key West, Fla.—Laying 67,000 yards of asphalt paving, to the Southern Asphalt Co., Birmingham, Ala., $150,000.

Rome, Ga.—Paving various streets with brick, wood blocks, and macadam, to Jamison & Hallowell, Montgomery, Ala., $13,304; Creosoted Wood Block and Paving Co., Gulfport, Miss., $5,317; Southern Asphalt and Paving Co., Birmingham, $29,769.40.

Chicago, Ill.—Paving Randolph and Clark streets with creosoted wood blocks, to William Bissack, $21,510.

Peoria, Ill.—Paving Sanford street ($14,-815), South Adams street ($14,815), and Lydia avenue ($11,285), to A. D. Thompson, Peoria.

Virginia, Ill.—Paving court house square and North Main street, to Richard Egan, Springfield, Ill., $27,806.

Winnetka, Ill.—Building four miles of asphalt concrete pavement, etc., to the Western Improvement Co., Racine, Wis.

Ames, Iowa—Paving five blocks of Grand avenue with creosoted blocks, to Wm. Horrabin, Iowa City, Ia.

Des Moines, Iowa—Paving Thirty-sixth street, sheet asphalt, to Mayer Bros. Paving Co., Des Moines.

Oelwein, Iowa—Constructing 42,000 square yards of brick block paving, to Dearborn & Jacsokn, Cedar Rapids, and William Horrabin, Iowa City, $80,000.

Red Oak, Ia.—Constructing twelve blocks Purington brick pavement, to Hamilton & Schwartz, Shenandoah, Ia.; curbing and guttering, to Horton Bros., Red Oak; nine blocks brick paving, to McMaken Bros., Plattsmouth, Neb.

Shenandoah, Ia.—Constructing 24,000 square yards of asphaltic concrete pavement, to M. Ford, Cedar Rapids, Ia.

Waterloo, Ia.—Repaving with asphalt in Fourth, Bridge and Commercial streets, to the Bryant-McLaughlin Asphalt Paving Co.

Bedford, Ind.—Constructing cement walk and brick pavement, to Ewing Shields, Seymour, Ind., $20,000.

Bloomington, Ind.—Constructing two miles of macadam road with asphalt binder, to George T. Miller, Lebanon, Ind., $24,994.

Fowler, Ind.—Constructing Erskine road, $3,300, and Gerlach road, $4,500, to Girmut & Co., Muncie, Ind.

Jacksonville, Ind.—Paving Meridian street to Ewing Shields, Seymour, Ind., $18,275.57.

Logansport, Ind.—Constructing roads as follows: Gray road, to H. A. Barnes & Son, Logansport, $8,978, and Cotner road, $8,845; Riley road, to E. E. Barnard, Delphi, Ind., $4,362; Stevens road, to Martin McHale, Logansport, $16,200, and Ross road, $16,587; Farlow road, to Barnes & Grauel, Logansport, $13,801; Ira Cotner road, to Browning & Shafer, Royal Center, Ind., $12,500; bridge and concrete work, to Samuel Cotner, Logansport.

Martinsville, Ind.—Constructing macadam road, to J. C. Greer, Martinsville, $8,519.

Newport, Ind.—Constructing Rock Spring gravel road, to George R. Chatman, Clinton, Ind., $7,740.

Rockville, Ind.—Building Bellmore road, four miles, to J. H. Van Fassan, Rockville.

Rushville, Ind.—Constructing two roads, to Wilk & Co., Rushville, $10,495.

Salem, Ind.—Constructing gravel road, to Christian & Engler, Salem, $17,095.

Terre Haute, Ind.—Constructing three miles of rock and gravel road, to Dorsey & Co., Terre Haute, $9,450.

Wabash, Ind.—Improving Manchester avenue, to the Western Construction Company, Lafayette, Ind., $44,000.

Atchison, Kas.—Paving Carney street, to the Atchison Paving Brick Co., $22,994; paving Waggener boulevard, to Arnold & Graves, $6,881.

Leavenworth, Kas.—Constructing asphalt pavement in Shawnee street, $19,234 square yards, $23,850, to Jo. Ramsey & Co., Topeka, Kas.

Shreveport, La.—Constructing street pavement, to the General Paving Co., Hot Springs, Ark., $175,000; Chatwin Bros. Riprap Contracting Co., Shreveport, $11,340; Southern Bilulithic Co., Nashville,, Tenn., $40,000.

Boston, Mass.—Constructing wood block pavement, etc., in East Fourth, Milk and Standish streets, $11,000; and in Washington street, $16,409, to James Doherty, Boston; Sachem street, to Daniel E. Lynch, $2,860; state highway in Swansea, to P. F. Giovannini, $4,226; along Stony brook, to Jones & Meehan, $29,212; in Champney street, to the J. C. Coleman & Sons Co., $5,332.

Detroit, Mich.—Paving in Lafayette boulevard, to Ferdinand Porath, Detroit, $6,081.

Ludington, Mich.—Constructing gravel road, to Clarence Sheppard, Ludington, $18,000.

Pontiac, Mich.—Paving South Saginaw street, etc., to Cleveland Trinidad Paving Co., $37,000.

St. Joseph, Mich.—Constructing brick pavement, to Chas. Kingsley and Henry Shultz, St. Joseph, $15,287.

Bemidji, Minn.—Constructing 21,000 square yards concrete paving, to the Northern Construction and Engineering Company, Grand Forks, N. D.

Duluth, Minn.—Improving West End streets, to Hugo Steele, $41,141; West Fifth street, to C. R. McLean, $3,590.60; Hartley road, to J. A. Johnson, $19,233, and E. A. Dahl, $4,500.68.

St. Paul, Minn.—Various street improvement works, to Fielding & Shepley, and Keough Bros., St. Paul, about $60,000.

Joplin, Mo.—Paving Main street, to Burke Bros., St. Louis.

Missoula, Mont.—Improving Connell avenue, to the Miracle-Tripp Company, Missoula, $13,643, and Hilda avenue, $10,493.

Concord, N. H.—Constructing state highways, five mile at Hooksett and Merrimack, to E. J. Rourke, Abington, N. H., $33,734; and one and one-third miles at Bedford, to C. W. Tryon, Meriden, Conn., $6,311.

Audubon, N. J.—Constructing cement pavement, to Edward Wiglesworth, Collingswood, N. J., $10,000.

Camden, N. J.—Resurfacing Westfield avenue, to the Kelly, McFeely Construction Co., $36,158.88.

Englewood, N. J.—Constructing asphalt block pavement on D street, to the Hastings Paving Company, New York, $9,574.

Hammonton, N. J.—Constructing sidewalks, to W. Kirkspear, $11,000.

Trenton, N. J.—Constructing Trenton, Lawrenceville and Brunswick pikes, to Willard S. Conover, $35,536.

Westfield, N. J.—Improving North avenue, macadam, etc., to Liddle & Pfeiffer, Perth Amboy, N. J., $10,420.

Elmira, N. Y.—Paving East Union Place with Corning block and Medina curb, to Connors & Gallavan, Elmira, $7,425.

Lancaster, N. Y.—Paving Central avenue, to the Niagara Construction Co., Buffalo, $37,949.

Larchmont, N. Y.—Laying 25,000 feet of cement sidewalk, to Daily & Merritt, Port Chester, N. Y., $20,000.

New York, N. Y.—Constructing wood block pavement in Richmond terrace, Staten Island, to the United States Wood Preserving Co., $44,722.40.

Utica, N. Y.—Repaving Oneida street with bitulithic, to Warren Bros. Co., $11,820.

Akron, O.—Paving High street, to McAlonan Bros. and S. W. Parshall, $50,000 each; Second street to Mather McCourt, $20,000; Johnson street to Walter & Russell, $35,000; Tallmadge avenue, to E. McShaffrey & Sons, $40,000; Water street ($25,000), and South street ($7,5000), to Wildes & Davidson, all local contractors.

Canal Dover, O.—Paving Wooster road, to Springer & Rogers, New Philadelphia, O., $29,660.12.

Sardington, O.—Constructing Osborn road, to Shaw & Uncapher, Marion, $16,076.36; Clark and Purinton road to Frank Holt and Tarper Fleming, $18,615; and Mills road, to L. R. McMichael, Bucyrus, $13,064.38.

Columbus, O.—Paving Thurman avenue, to the Andrews Asphalt Paving Co., Hamilton, O., $24,000, and Wilson avenue, $16,000; Michigan avenue, to J. C. Beasley, Columbus, $21,000; Johnson street, to William M. Graham, $15,000, and Cleveland avenue, $15,000; Chittenden avenue, to George W. Patterson & Son, $10,000; Rich street, to Geigle, Garnes & Co., Columbus, $13,000.

Fayette, O.—Constructing 8,000 square yards street pavment, etc., to M. F. O'Sullivan, Fayette, $18,000.

Marion, O.—Constructing Tron pike, to Hofstetter & Dawson, $7,714; Cardington road, to M. W. Shaw & L. D. Uncapher, $17,000.

Marion, O.—Paving Olney and Blaine avenues, to Carpenter & Andrews, Grand Rapids, Mich., $19,712.

Martins Ferry, O.—Constructing Pultney township pike, to W. J. McClain, Bellaire, O., $18,000.

Mineral City, O.—Piking county roads, to Edward A. McCollam, G. A. Genfet, and Kimmel Steinbaugh.

Tiffin, O.—Constructing pavement, to W. & H. Jeckle, Holgate, O., $13,979; E. A. Freshwater & Sons, Cleveland, $13,766; John E. King, Franklin, O., $32,355; and Louis Schauder, Tiffin, $3,889.

Toledo, O.—Repairing Jerusalem stone road No. 4, Garrigan Bros., Toledo, $27,167.

Xenia, O.—Constructing roads under the state highway law, to the Wilson Engineering & Contracting Co., Xenia, $13,225; and to Korah E. Kunle, Dayton, $5,769.

Duncan, Okla.—Laying brick pavement in the business district, to Connelly Construction Co., ElReno, Okla., $55,000.

Oklahoma City, Okla.—Paving Olie street with asphalt, to Cleveland Terminal Paving Co., $28,278; Harvey avenue, to the Western Paving Co., $29,322.

Hood River, Ore.—Paving, curbing, etc., aggregating $32,252, to C. Johnson, The Dalles, Ore.

Independence, Ore.—Laying five blocks concrete paving, about $14,000, to Bidwell, Hayden & Co., Portland, Ore.

McMinnville, Ore.—Paving 62 blocks in the business district and part of the residence district with bitulithic, to Warren Construction Co., Portland, Ore., $120,000.

Portland, Ore.—Constructing asphalt pavement in Skidmore and other streets, to Warren Construction Co., $306,383; grading and laying curbs and sidewalks in East 34th street, to Miller & Bower, $20,031.

Harrisburg, Pa.—Constructing state highway between Ligonier and Stoyestown streets (23½ miles), to J. H. McQuaide, Pittsburgh; and between Bedford and Stoyestown (25 miles), to H. G. Hinkle, Altoona.

Mt. Carmel, Pa.—Constructing 26,000 sq. yd. brick pavement, to Fendale & Co., Mt. Carmel, $62,000.

Mt. Pleasant, Pa.—Constructing roads, to McGrady & Co., Braddock, $71,248; H. B. Cunningham & Son, Turtle Creek, $45,217; and P. J. Keck, Homestead, $73,762.

New Castle, Pa.—Repaving Long avenue, to Burns Bros., $7,209; Washington street, to W. H. Maguire, $15,401.50, and to New Castle Contracting Co., $3,107.60; North street, to W. H. Marquis, $8,523.97; storm sewers, to Burns Bros. and to Kimbrough & Elder.

Pittsburgh, Pa.—Raising streets in the flood district, north side, to John F. Casey, $29,380.88; repaving Liberty avenue, to Booth & Flinn, Pittsburgh, $23,982.30; paving Harwood street, to Ott Bros., Pittsburgh, $9,024.37.

Reading, Pa.—Macadamizing streets, to John Weidner, $10,075.08.

Washington Pa.—Furnishing brick for ten county roads, to United Fire Brick Co., Uniontown; Pennsylvania Clay Co., Pittsburgh; the Pittsburgh Buffalo Co., Pittsburgh; and James M. Porter, Pittsburgh; also constructing 22 miles of brick-paved highway, aggregating $348,259.95, to F. J. Erbeck of Homestead, Collins-Gordon Co. of Pittsburgh, Samuel Gamble of Carnegie, Hastings & Piper of Charleroi, Reed & Liggett of Washington, and William Pickett & Co. of Washington.

Chattanooga, Tenn.—Paving Whiteside and Main streets and Georgia avenue with sheet asphalt, to the West Constructing Co., Chattanooga, $75,138.

Nashville, Tenn.—Constructing 5,000 lineal feet of granitoid curbing and sidewalks, to M. J. Cunniff & Co.

St. Elmo, Tenn.—Paving Westside and Main streets and Georgia avenue, to West Construction Co., Chattanooga, $75,138.

Longview, Tex.—Constructing street pavement, to Roach & Monigon, Memphis, Tenn., $60,000.

Bellows Falls, Vt.—Grading and paving Bridge street, to Robinson & Baldasaro, Bellows Falls.

Norfolk, Va.—Paving, etc., on Graydon avenue, to Louis Lawson, Norfolk.

Bellingham, Wash.—Paving Dupont street with bitumass, to the Northwest Bitumass Co., $10,500.

Pasco, Wash.—Constructing concrete walks and curbs, to Midland Engineering Co., North Yakima, $44,000; and to Jahn Contracting Co., Seattle.

Seattle, Wash.—Paving, etc., in Yeseler way, to Allain & Ball, Seattle, $8,261.50.

Seattle, Wash.—Paving, etc., in 26th avenue, to W. F. Manney & Co., Seattle, $14,-138; in University street, to Allain & Hull, Seattle, $6,524.

Seattle, Wash.—Constructing sidewalks on 32nd avenue, to Allain & Hull, Seattle, $4,-382.25; sidewalks on Weller street, to Smith Contracting Co., Seattle, $4,458.40; and paving 21st avenue North, to Barber Asphalt Co., $122,835.85.

Seattle, Wash.—Constructing E. H. Patton road, to Zindorf & Elliott, $4,743; Gehr Erickson road, to P. J. McHugh, $39,600; permanent highway No. 3, to Beel-Scott Co., $44,970; permanent highway No. 1, to Barber Asphalt Paving Co., $26,560; Yesler Way, to Allain & Hull, $8,262.

Seattle, Wash.—Constructing sidewalks on 32nd avenue, to Allain & Hull, Seattle, $4,-382.25; sidewalks on Weller street, to Smith Contracting Company, Seattle, $4,458.40; and paving 21st avenue North, to Barber Asphalt Company, $122,835.85.

Spokane, Wash.—Grading, paving, etc., on Northwest boulevard, to J. S. Hill, Spokane, $121,720.

Spokane, Wash.—Paving, etc., to Bitumass Paving Co., Spokane, $3,640; Western Asphalt Paving Company, Spokane, $27,585.29; Inland Empire Hassam Paving Company, Spokane, $15,993; Naylor & Norlin, Spokane, $6,449; Massie Bros. & Long, Spokane, $7,750.

Tacoma, Wash.—Paving South 25th street, to the Keasal Constructing Company, $88,-200.

Tacoma, Wash.—Regrading and paving South 25th street, to the Keasal Construction Company, $88,200.

Vancouver, Wash.—Constructing 8 miles of state road No. 77, to W. F. Guernsey, Vancouver.

Vancouver, Wash.—August 7, 8 p. m. Improving Franklin, Daniel, Columbia, 23rd and 25th streets, to J. F. Geoghegan.

Vancouver, Wash.—Laying sidewalks, etc., to Rector & Daily, $95,000.

Wenatchee, Wash.—Paving, etc., to Columbia Engineering and Construction Company, $49,887.

Wheeling, W. Va.—Constructing 17th street bridge, to the Independent Bridge Company, Pittsburgh, $8,000.

Green Bay, Wis.—Paving Dousman and East Walnut streets with sandstone blocks and Congress street with concrete, to the McGrath Construction Company; paving Adams street with asphalt, to John Brogan.

Milwaukee, Wis.—Paving various streets, about 198,000 square yards, to R. F. Conway Company, Chicago, $254,704.

Milwaukee, Wis.—Constructing bituminous pavement on Vliet and 27th street, to Badger Construction Company, Milwaukee, Wis.

Rhinelander, Wis.—Improving streets, to McGrath Construction Company, Green Bay, $13,625.

Sheboygan, Wis.—Constructing brick pavement, to Franz Radolff, Plymouth.

Superior, Wis.—Constructing cement sidewalks on Hammond avenue, to Ed. Johnson, 63½ cents per foot.

Hastings, Ont.—Constructing 50,000 square feet of cement pavement, to the Martin Jex Company, Cobourg.

Burnaby, B. C.—The American consul reports that contracts have been awarded for construction of sewers and pavements. The names of successful bidders and other particulars may be obtained from the Bureau of Manufactures, Washington, D. C.

Vancouver, B. C.—Paving, etc., to George Ledingham, Vancouver, $73,000; Columbia Bitulithic Company, Vancouver, $46,948; T. R. Nickson & Co., Vancouver, various contracts aggregating about $84,000.

CONTEMPLATED WORK.

Marianna, Ark.—The county has issued $100,000 bonds for road improvements.

Pine Bluff, Ark.—The city council has organized a district to pave streets with creosoted wood blocks. Wm. J. Parks, engineer.

Los Angeles, Cal.—The board of public works has authorized the purchase of 11,000 barrels of crude oil for use on the roads.

Marysville, Cal.—The city council has ordered the paving of C street.

San Francisco, Cal.—The board of supervisors have ordered the construction and paving of sidewalks in Third and Precita avenues and other streets.

San Mateo, Cal.—The trustees have voted to improve the roads in San Mateo Park with oiled macadam. $100,000. City engineer.

Selma, Cal.—The pavement of the princi-

pal business streets is contemplated.

Colorado Springs, Colo.—The city council has ordered street paving.

Steamboat Springs, Colo.—The city has voted $34,000 bonds for paving.

De Funiack Springs, Fla.—The county has voted $70,000 bonds for road building.

Jacksonville, Fla.—The county commissioners have ordered pavement on the Duval station road and concrete bridges on the Pensacola road.

Council Bluffs, Iowa. — The council has authorized the improvement of Harrison street.

Marshalltown, Ia.—The city council has ordered the paving of Fourth, Jerome and Park streets.

Belvidere, Ill.—Bonds have been sold for paving, $24,000.

Peoria, Ill.—The city council has authorized the grading of Chestnut and Jackson streets and the construction of sidewalks on four streets.

Pontiac, Ill.—The city council has voted to pave West Henry street, $10,640.

Rantoul, Ill.—The city council has voted to pave Sangamon avenue, the principal business street.

South Bend, Ind.—The board of public works have ordered the paving of Race, Front, Third and Spring streets. Wm. S. Moore, city engineer.

Bellevue, Ky.—The city council has ordered the construction of paving, etc., in Grandview avenue. Geo. Trunnel, Jr., city clerk.

Pittsburg, Kan.—The city has voted $225,000 to buy water plant and $40,000 to improve and extend same. L. E. Curfman, city engineer.

Topeka, Kan.—The city commissioners have provided for paving 10 blocks in Chandler, Branner, Lake, Line and Lawrence streets.

Duluth, Minn.—The city council has authorized the improvement of Regent street. Board of park commissioners.

Hibbing, Minn.—The city council has ordered the construction of cement sidewalks on several streets.

Litchfield, Minn.—Cement sidewalks have been ordered in on several streets. John Rodange, village recorder.

Pipestone, Minn.—Cement sidewalks have been ordered in on several streets. S. W. Funk, city recorder.

Fulton, Mo.—The city has voted to form a special 8-mile road district.

Kirksville, Mo.—The city council has ordered the paving of East Harrison and North Elson streets and various alleys. J. C. Carothers, city clerk.

Albany, N. Y.—The Governor has signed appropriations for $1,000,000 to highway improvemtnts in Onondaga and Jefferson counties, $250,000 in Greene county and $450,000 in Oswego and Onondaga counties.

Albany, N. Y.—The state has appropriated $380,000 for the construction of a highway from Brewster northward.

Elmira, N. Y.—The common council has authorized paving in Desmond, Lockhart, Lehigh and Packer avenues.

Irvington, N. J.—The town council has authorized paving in Fortieth and Twentieth streets. M. Stockman, town clerk.

Penn Yann, N. Y.—The village has voted bonds for paving Main and East Main street with brick, $75,000.

Max, N. D.—Cement sidewalks have been ordered in on several streets. Theo. W. Kamps, village clerk.

Akron, O.—The city council has ordered grading, paving, etc., in Jefferson and Wooster avenues. D. W. Harter, clerk.

Athens, O.—The village council has authorized the paving in First, Lancaster and Walker streets and Miller alley. W. B. Golden, clerk.

Barnesville, O.—The city contemplates improving Mulberry, North Broadway, Church, St. George and Laws streets. F. W. Hilles, city clerk.

Bellaire, O.—The city council has ordered curbing and sidewalks on Twentieth street. G. W. Althar, clerk of council.

Cincinnati, O.—The city council has ordered the paving of Delaney street. Edwin Henderson, clerk.

Cleveland, O.—The city council has authorized the improvement of the boulevard between Woodland Hills and Garfield Park.

Cleveland, O.—The city council has voted to construct paving in McCurdy, 104th and West 35th streets, Otto and Gibson avenues, St. Alexis court and Parkwood drive.

Columbus, O.—The city council has passed resolutions for the paving of Allen and Thirteenth avenues, and for the construction of 5-foot cement sidewalks on four streets.

Dayton, O.—The city council has authorized grading and graveling of Wildwood and Epworth avenues and Haller street. Wayne E. Lee, clerk of council.

East Liverpool, O.—The city council has ordered the improvement of St. Clair avenue and St. George street.

East Liverpool, O.—The city council has authorized grading and paving in Travis alley, Minerva street, Apple alley and Green lane. C. V. Beatty, director of public service.

East Liverpool, O.—The city council has voted to grade St. Clair, West Eighth and St. George streets. R. L. E. Chambers, clerk.

London, O.—The city council has authorized the paving of First, Main and Fifth street, about 6,700 lineal feet.

Mansfield, O.—The city council has authorized grading and laying sidewalks in Buckley and Western avenues. Director of public service.

Marietta, O.—The city council has voted to pave Glendale street. V. B. Hovey, president.

Middletown, O.—The city council has authorized paving in Christel and Titus avenues. John Kunz, clerk.

Mineral City, O.—The county has ordered construction work on the Jefferson township and Newport pikes.

Niles, O.—The city council has authorized the paving of Vienna street.

Sebring, O.—The city council has authorized the paving of Ohio avenue. Harry Jenkins, clerk.

Steubenville, O.—The city council has ordered the improvement of Sinclair avenue and North Sixth street. Thomas W. Porter, mayor.

Toledo, O.—The city council has authorized grading and paving in Scottwood avenue. John M. Babcock, clerk.

Toledo, O.—The city council has authorized the paving of Woodland avenue and Buffalo and Mulberry and nine other streets. John M. Babcock, clerk of council.

Youngstown, O.—The city council has voted to pave Hayes avenue. M. F. Hyland, city clerk.

Youngstown, O.—The city council has ordered the grading of Plum street and paving in Hazel street and Grace avenue. M. F. Hyland, clerk.

Tulsa, Okla.—The city has voted $291,000 bonds for the construction of water works, sewers, fire department, street improvements, etc. E. B. Cline, city clerk.

Medford, Ore.—The city council has ordered 100,000 square yards of asphalt pavement in various streets.

Beaver Falls, Pa.—The council has authorized the improvement of Twenty-first street. Borough secretary.

Butler, Pa.—The city council has voted to do a considerable amount of paving during the remainder of the season.

Carnegie, Pa.—The town council has authorized the grading and paving of Highland avenue. H. R. Bigham, borough clerk.

Carnegie, Pa.—The council has voted to

pave Highland avenue and Homstead with brick. H. R. Bigham, borough clerk.

Charlevoi, Pa.—The town has voted $65,000 bonds for street improvements, a garbage plant and a municipal building.

Crafton, Pa.—The town council has ordered the construction of cement or stone sidewalks in Berry street. D. H. Haines, secretary.

Greenville, Pa.—The town council has ordered paving in North Race, South Race and North Mercer streets. J. M. Hittle, secretary.

Harrisburg, Pa.—The common council has ordered the pavement of Holly street. Chas. A. Miller, clerk.

Harrisburg, Pa.—The city council has authorized the grading of Kittatinny street and the paving of Basin alley and Holly street. Chas. A. Miller, clerk.

Harrisburg, Pa.—The common council has authorized the paving of Holly street with asphalt. Charles A. Miller, clerk.

Ingram, Pa.—The town council has authorized the paving of Hodgson avenue and Catherine street. D. H. Hainer, secretary.

Johnsonburg, Pa.—The town council has authorized the grading and paving of Grant street. S. W. Bayless, secretary.

McKees Rocks, Pa.—The borough council has authorized repaving with Ligonier blocks or stone blocks in Chartiers avenue. Jno. P. Pastre, secretary.

Monongahela, Pa.—The city has voted $65,000 bonds for street improvements.

Mt. Pleasant, Pa.—The town council has voted to grade, curb and pave North Shupe street. M. A. King, secretary of council.

New Castle, Pa.—The council has authorized several new paving contracts.

New Castle, Pa.—The city council has voted to grade Franklin avenue. H. M. Marquis, city clerk.

Parnassus, Pa.—The city has voted $22,000 bonds for street improvements.

Philadelphia, Pa.—Widening and raising the grade of Chestnut street as an approach to the Schuylkill river bridge, $40,000.

Pittsburgh, Pa.—The city council has authorized the paving of Fairplay street, $14,000. Joseph G. Armstrong, director department of public works.

Rankin, Pa.—The town council has authorized the paving of Fourth avenue. Carl Koellman, borough secretary.

Reading, Pa.—The city council has authorized the paving of Court, Fifth and Seward streets.

Scranton, Pa.—The city council has authorized the paving of Vine street, $2,068.50. Evan R. Morris, city clerk.

Scranton, Pa.—The council has voted to pave Oakford court. Evan R. Morris, city clerk.

Scranton, Pa.—Paving Kressler, Hitchcock and Vine court and Moir street and Prospect avenue; about $40,000.

Scranton, Pa.—The city council has authorized the repair of pavement in Providence road, $15,000. Evan R. Morris, city clerk.

Shamokin, Pa.—The town council has authorized the paving of Clay street with Pinegrove block. T. C. Roberts, secretary.

Sharon, Pa.—The town council has authorized paving in Shenango street, Mercer avenue and Park way.

Somerset, Pa.—The town council has voted to pave Rosina and East streets.

South Sharon, Pa.—The borough council has authorized the paving of Fruit street. John J. Noland, borough secretary.

Swissville, Pa.—The borough council has ordered the paving of Park avenue.

Swissville, Pa.—The town council has authorized the paving of McCague and Burton streets and Lloyd avenue. W. J. Cupples, secretary.

Wilmerding, Pa.—The council has authorized the paving of Locust alley. C. R. Shiring, borough secretary.

Chattanooga, Tenn.—The city commissioners have appropriated $25,000 for street improvements and sewers.

Jonesboro, Tenn.—The county court has voted $60,000 bonds to build the Bristol-to-Memphis highway in Washington county.

Bonham, Tex.—The city council has decided to pave Main street and the public square.

Dallas, Tex.—The city commissioners have ordered the paving of Jefferson street, two blocks. J. E. Lee, street commissioner.

Dallas, Tex.—The county has voted bonds for road improvement, $500,000.

Houston, Tex.—The city council has ordered all steam railroads shall pave their crossings at street intersections with brick.

Longview, Tex.—The city has voted $100,000 for road improvements.

Marquez, Tex.—The citizens have voted $30,000 bonds for road improvements.

Alexandria, Va.—The board of aldermen has ordered pavement, etc., in Cameron and Fairfax streets.

Dayton, Wash.—The city council has voted to pave Main and Commercial streets, about $80,000.

Follansbee, W. Va.—The city has voted $17,000 bonds for street paving.

Grafton, W. Va.—The city council has provided for the paving of West Main and Luzadder streets.

Milwaukee, Wis.—The construction of a boulevard along the Janesville plank road is contemplated.

Burnaby, B. C.—The American consular service reports that extensive road improvements are contemplated.

Coquitland, B. C.—The American consul general reports that the city contemplates purchasing two road rollers, one large and one small.

Point Grey, B. C.—The city has voted $349,908 bonds for roads.

Pernambuco, Brazil.—The American consul reports that the city has undertaken extensive street and park work.

SEWERS.

BIDS REQUESTED.

Prescott, Ark.—September 6. Constructing sewer improvements, district No. 1. 49,000 feet of pipe, 120 manholes, sewage treating bed, etc. M. W. Gresson, secretary commissioners; James W. Beebe, engineer.

Lemoore, Cal.—September 11, 8 p. m. Constructing sewer system. E. T. A. Bartlett, city clerk.

Wallingford, Conn.—September 5. Constructing sewer in Randolph street and Hall avenue. Court of burgesses.

Bushnell, Ill.—September 7, 7:30 p. m. Constructing 5 blocks of sewers.

Galveston, Ind.—September 6, 8 p. m. Constructing two sanitary district sewer systems. Eugene Masters, town clerk.

Peru, Ind.—September 2. Furnishing ½ mile of 6-inch to 12-inch drain tile. F. McElheny, auditor Miami county.

Belle Plaine, Ia.—September 11. Constructing 11½ miles of 8-inch to 18-inch sanitary sewers. S. H. Ferree, city clerk; Charles P. Chase, Clinton, Ia., engineer.

Paducah, Ky.—September 5, 10 a. m. Laying 1,146 feet of cast iron drain pipe. L. A. Washington, city engineer.

Lake Charles, La.—September 11. Constructing about 22 miles clay-pipe sewers, with pumping station and four reduction tanks. A. A. Wentz, secretary; W. G. Kirkpatrick, Jackson, Miss., engineer.

New Orleans, La.—September 11, 12 m. Constructing Napoleon avenue system of drainage canals and pipe lines; approximately 63,000 feet of reinforced concrete terra cotta pipe lines, etc. Certified check, $10,000. F. S. Shield, secretary sewerage and water board.

Baltimore, Md.—September 6, 11 a. m. Constructing lateral sewer in district 20B; high-level intercepter, section No. 4; and storm-water drain. Separate bids. Certified check with each bid. Harry W. Rodgers, secretary sewerage commission.

New Bedford, Mass.—September 6. Laying 3,300 feet of 60-inch pipe in Buzzards Bay. Wm. F. Williams, city engineer.

Clarksdale, Miss.—September 5, 8 p. m. Constructing 22,000 feet of 8-inch and 10-inch sanitary sewers, 2,650 feet of 18-inch to 30-inch storm sewers, manholes, flush tanks, etc.; also water works system. Certified check 3 per cent. M. W. Purnell, city clerk; W. S. Bobe, engineer.

Newburgh, N. Y.—September 5. Constructing tile pipe sewer along the open ditch on the south side of Washington Heights, about 1,400 feet. City clerk.

Port Clinton, O.—September 18, 12 m. Constructing sewer in Adam street. Certified check, $200. J. A. Singler, village clerk.

Duquesne, Pa.—September 2, 12 m. Lowering sewer in West Grant avenue and Matlack street. L. W. Francis, chairman sewer committee.

Rock Hill, S. C.—September 15. Constructing three sewage disposal plants, consisting of Imhoff tanks, contact beds, etc. Thos. Gothran, engineer.

Mitchell, S. D.—September 4, 8 p. m. Constructing lateral sewers. N. H. Jensen, city auditor.

Colonial Beach, Va.—October 11. Constructing water works and sewer system. Harry Stevens, Union Trust Bldg., Washington, D. C., consulting engineer.

Toronto, Ont.—September 12, 12 m. Constructing storm overflow sewer and high-level intercepter, in all about 10,000 lineal feet. C. H. Rust, city engineer.

CONTRACTS AWARDED.

Phoenix, Ariz.—Constructing 50 miles of sewers and appurtenances, to the American Light & Water Company, Chicago, $308,940.

Kingsbury, Cal.—Constructing water works, to Braun, Williams & Russell, San Francisco, $19,447.

Los Angeles, Cal.—Constructing sewer in Vermont avenue, to Joe Chutuk, $29,819.

San Francisco, Cal.—Constructing main sewer in Howard street, to John Daniels, $90,758; and the Healy & Tibbitts Construction Company, San Francisco, $92,254; several sections of the North Point main sewer, to Healy & Tibbitts Construction Company; section D-3 North Point main sewer to F. Rolandi.

San Mateo, Cal.—Constructing sewers and septic tank, to J. A. Wilson, San Mateo, $23,000; pumping station, to the United Iron Works, San Francisco.

Winters, Cal.—Constructing sewer system, to the Dozier Construction & Engineering Company, Sacramento, Cal., $20,370.

Colorado Springs, Colo.—Constructing sanitary sewers, to J. S. Schwartz, Colorado Springs, $18,577.

Denver, Colo.—Constructing storm sewers, to the Gaffy & Keefe Construction Co., $8,-140; Denver-Pueblo Construction Company, $13,181.04.

South Norwalk, Conn.—Constructing sewers in Stuart, Fairfield and Connecticut avenues, to Streuli & Puckhafer, Bridgeport, Conn.

Washington, D. C.—Contracts for construction of sewers and pavements in Burnaby, B. C., have been awarded. The names of successful bidders and other particulars may be obtained from the Bureau of Manufactures.

St. Maries, Idaho.—Constructing the sewer system, to Hensen & Elbury, Salt Lake City, Utah, $15,000.

Berwyn, Ill.—Constructing pipe sewer on Hiawatha avenue, to David H. Airey, Morgan Park, $9,570.

North Chicago, Ill.—Constructing sewer system, to Wm. Moran & Co., Waukegan, $45,510.

Waukegan, Ill.—Constructing sewer system in Arlington Heights, to Lanyoun & Clifford, Waukegan, $74,000.

Muscatine, Ia.—Sewerage work as planned for the present summer, to the Independent Construction Company, Davenport, $4,964.64.

Valley Junction, Ia.—Constructing sanitary sewers, to George M. King Construction Company, Des Moines, $15,159; outlet and disposal plant, to George A. Mallory & Co., Kewannee, Ill., $12,329.

Waterloo, Ia.—Laying sewers in Home Park boulevard and six other streets, to the Black Hawk Construction Company.

Hoisington, Kan.—Constructing 8.2 miles of sewers and a disposal plant, to Bash & Gray, Great Bend, Kan., $35,011.

Wichita, Kan.—Constructing Douglas avenue storm sewer, to John Striffler, Wichita, $10,028.75; four sanitary sewers, to W. W. Cook & Sons, Junction City, Kan., aggregating $15,000.

Louisville, Ky.—Constructing Long avenue pipe sewer, to Koppelman & Eddy, Louisville, $1,892.

Baltimore, Md.—Constructing sewers; valve and pipe work, to the B. F. Sweeten Company, $29,093.50; building sewer, to S. K. Abbott, $998.45.

Cumberland, Md.—Constructing sewers, to Varig Construction Company, Cumberland, $18,920.

Milford, Mass.—Constructing section 8 of sewer system, to Cendella & Co., Milford, $22,306.

Pittsfield, Mass.—Constructing sewer, to David A. Dory, Natick, $23,819.

Detroit, Mich.—Completing the Fairview sewer, to John Ginzel, $32,700.

Ely, Minn.—Constructing trunk sewers, sedimentation tank and water mains, to H. L. Bartlett, Virginia, Minn., $12,000.

Eveleth, Minn.—Constructing sewers in Garfield and Elba avenues, etc., to the Pastoret-Lawrence Co., Duluth, $10,000.

Fairmount, Minn.—Constructing water mains and sewers, to J. W. Turner & Co., $13,000.

Kansas City, Mo.—Constructing sewers; 14,000 feet of sewer, to Michael Walsh, $21,-461; William Mullin, $92,187; Bernard Corrigan (O. K. Creek sewer), $850,000; R. J. and Wm. Boyd, Kanas City, Kan., $22,154.

St. Louis, Mo.—Reconstructing Ferry street sewer, to Fruin-Colnon Contracting Company, St. Louis, $29,872.

Whitefish, Mont.—Constructing sewers, to Sam Odergard, Kalispell, $13,500; septic tanks, to W. A. Powers, Kalispell.

Neligh, Neb.—Constructing sewers, to Guy E. Smith, Indianola, Ia., $7,353.

Paterson, N. J.—Constructing West Paterson and Totowa sewer: Section A, to M. Kiernan & Bergin, $28.304.75; section B, to McKiernan & Bergin, $14,081.77; section C, to Frank Puglia, Paterson, $2,648.65, and Union Building & Construction Company, Passaic, $6,472.55; section D, to Frank Puglia, $4,067.40; sections E, F and G, to Union Building & Construction Company, $54,000.

Frankfort, N. Y.—Constructing sewer system, to John R. Baxter, Jr., Utica, $56,385.

North Tonawanda, N. Y.—Constructing Rumbold avenue sewer system, etc., to the Frontier Construction Company, Buffalo, $11,498.

Utica, N. Y.—Constructing Lafayette street sewer, to N. G. Peters, $4,105.32.

Chapel Hill, N. C.—Constructing sewer system, to Streater & Anderson, Gaffney, S.C.

Ada, O.—Constructing sewers, to the Van Meter Construction Company, Kenton, O., $26,000.

Akron, O.—Constructing public comfort station of stone and marble, to Hunt & Wigley, $10,000.

Cincinnati, O.—Constructing sewer in Vir-

ginia and Washburn avenues, to John E. Mahoney, Cincinnati, $6,258.

Conneaut, O.—Constructing Jackson street sewer, to Charles Hukari, Ashtabula, $5,635.

Lancaster, O.—Constructing sewer in West Sixth avenue, to Glover & Sheets, $2,867.59.

Miamisburg, O.—Constructing the Smith street sewer, to Paul & Kershner, Dayton, $14,654.

West Lafayette, O.—Constructing storm sewer system, to Trainer & Scanlon, Huntington, W. Va., $15,584; combined surface-water and sanitary sewer, to Houston & Henderson, Logan, $12,395; First and Fourth ward sewers, to L. P. Battefeld, Bucyrus, $8,152.

Youngstown, O.—Constructing storm sewer and brick pavement, to Olson & Turner, Youngstown, $16,124.50.

Altus, Okla.—Constructing sewers, to J. N. Mayfield, $25,000.

Chandler, Okla.—Constructing sewers, to Van Meter & Co., Oklahoma City, $16,600.

Oklahoma City, Okla.—Constructing sewers, to Derr & Broderick and to Reinhart & Donovan; total, $26,821.12.

Tulsa, Okla.—Constructing sanitary trunk sewer, to E. G. Pike & Co., $9,237.97; and C. O. Frye & Son, $6,688.29.

Baker City, Ore.—Constructing sanitary and storm sewers, to J. C. White.

Klamath Falls, Ore.—Constructing third unit of sewer system, to Thomas H. Simpson and E. E. Phipps, Ashland, $12,067.

La Grande, Ore.—Constructing $40,000 sewer extension, to W. H. Sutherland, Walla Walla, Wash.

McMinnville, Ore.—Constructing storm sewer, $8,828, to Dennis & Christensen.

Salem, Ore.—Constructing Union street sewer, cement pipe, to the John Construction Company, Portland, $46,678.

Crafton, Pa.—Constructing complete sewer system in West Pittsburgh Terrace section, to the Wm. Jones Company, Carnegie, $5,827.65.

Johnstown, Pa.—Constructing sewage disposal plant, to Ralston & Myers, M. Vernon, O., $13,900.

Ligonier, Pa.—Constructing sewage pumping plant and sewage purification plant, to Ralston & Meyers, Mt. Vernon, O., $13,900.

McKeesport, Pa.—Constructing East End sewer, to Bowman Bros. Co., Pittsburgh, $8,265.93.

Oliphant, Pa.—Constructing Fourth ward sewer, to B. F. O'Boyle, Dunmore, $25,000.

Pittston, Pa.—Constructing trunk sewer in Price street, to James Munley, $6,318.

Madison, S. D.—Constructing sewer system, to Meeker & Dobson, Lincoln, Neb., $28,499.

Nashville, Tenn.—Constructing seven miles of sewers, to the E. T. Lewis Co., Nashville, $279,633.

Dallas, Tex.—Constructing storm sewer on Winnetka Heights, to Joe B. Winslett, Jr., Dallas, $9,466.50.

Ft. Worth, Tex.—Constructing sewer mains, to J. W. Moore, Ft. Worth, $12,246.87.

Lubbock, Tex.—Constructing complete sewer and water system, to E. L. Dalton and Eugene Campbell, Dallas.

Norton, Va.—Constructing 6½ miles of sewers, to John Jenkins, Norton, Va., $21,322.

Seattle, Wash.—Cohstructing sewers in Eleventh avenue, etc., to Nelson & Carlson, Seattle, $8,350; North Sixty-sixth street, etc., to Dahlstrom & Rodal, Seattle, $21,963.60.

Seattle, Wash.—Furnishing 40,000 barrels cement for the Interbay section of north trunk sewer, to Washington Portland Cement Co. and Superior Portland Cement Co., both of Seattle.

Shelton, Wash.—Constructing 17,000 feet of vitrified pipe sewer, to McKim & Nevins, Puyallup, $9,929.

Chippewa Falls, Wis.—Constructing sewer on Grand avenue, to Fraser & Danforth, St. Paul, $5,201.

Independence, Wis.—Constructing a sewer system, to F. C. Robinson & Co., Manitowoc.

Janesville, Wis.—Constructing sewers, districts 11, 14 and 16, 350 feet, to Tubey Bros., Dubuque, Iowa.

Madison, Wis.—Constructing the first part sewer system, to Meeker & Dobson, Lincoln, Neb., $30,000.

Port Washington, Wis.—Constructing sewer mains, to Wm. Moran & Co., Joliet, Ill., $26,305.

New Westminster, B. C.—Furnishing vitrified sewer pipe, to C. Gardiner Johnson, $14,361.

Victoria, B. C.—Constructing sewer system, to Angus Smith, $99,860.

Winnipeg, Man.—Constructing sewers as follows: Trunk sewer and Mission street sewer to Van Hornback Company, $63,403 and $26,731.53 respectively; Montcalm street sewer to Hern & Knox, $1,953; various other sewers, to Felix Gottonier, aggregating $8,178.15.

CONTEMPLATED WORK.

Coronado, Cal.—The trustees have authorized the construction of sewers. W. Tilden Clark, city clerk.

San Francisco, Cal.—The board of supervisors have authorized the construction of sewers in section M, North Point main sewer, $90,000. W. R. Hagerty, clerk.

San Francisco, Cal.—The board of public works has been authorized to construct sewers in Glen Park Extension, $25,000, and North Point main sewer, $85,000, and various other sections. W. R. Hagerty, clerk board of commissioners.

Jacksonville, Fla.—The city council has ordered the laying of sewers in many streets.

Pensacola, Fla.—The city council has passed an ordinance for general sewer construction.

Quincy, Ill.—The city council has authorized the construction of sewers on Payson avenue and Spring and Oak streets, $16,300.

Belle Plaine, Ia.—The city has voted bonds for the digging of a deep well and the construction of a sewer system.

Ottumwa, Ia.—The city council has ordered the construction of sewers in Chester and Pennsylvania avenues, Willard and Ranson streets, and certain alley.

Lawrence, Kan.—The city engineer contemplates building a storm sewer through the west part of the city; paving has been ordered in Rhode Island, Berkeley, Pennsylvania and Hancock streets.

Wichita, Kan.—The city commissioners have authorized the construction of storm water and sanitary sewers, $12,000. Bert C. Wells, city engineer.

Lexington, Ky.—The board of aldermen have ordered the construction of sanitary sewer on College View avenue. J. E. Cassidy, city clerk.

Kentwood, La.—The city has voted $50,000 bonds for the construction of water works and sewer system. G. F. Conan, Brookhaven, Miss., engineer.

Caro, Mich.—The city has voted $17,500 to complete its sewer system.

Lucerne, Minn.—The city council has authorized the construction of sewers.

Minneapolis, Minn.—The city council has ordered the construction of Hopewell Hospital sewer, $75,000.

St. Paul, Minn.—The board of public works has ordered the construction of a sewer in St. Anthony avenue, $11,000.

Excelsior Springs, Mo.—The city council has ordered the extension of the main sewer. B. Van de Greyn, city engineer.

Tecumseh, Neb.—The city has voted bonds for the construction of sewers, $7,000.

Bradley Beach, N. J.—The citizens have

voted $15,000 bonds to extend the sewer system.

Edgewater, N. J.—The city has voted to construct a sewer system.

Irvington, N. J.—The town council has authorized the repairing of sewers in Fortieth street. M. Stockton, town clerk.

Albany, N. Y.—Governor Dix has signed a $500,000 additional appropriation for the construction of the West Chester county trunk sewer in the Bronx valley.

Binghamton, N. Y.—The city council has ordered the construction of sewers on Pennsylvania and Vestal avenues.

Depew, N. Y.—The village contemplates building 10,000 feet of new sewer.

Franklinville, N. Y.—The city has voted $50,000 for the construction of sewers.

Long Island City, N. Y.—The board of estimates has authorized building of sewers in Rockaway road, Panama street, Stanley avenue and Shenandoah street, $72,300.

Poughkeepsie, N. Y.—The board of public works has ordered the construction of a sewer in Fairview avenue.

St. Johnsville, N. Y.—The village board has voted to extend the sewers and water mains in William street and Failing avenue.

Syracuse, N. Y.—The board of estimate and apportionment has approved the issue of $200,000 bonds for intercepting sewer.

Akron, O.—The city council has authorized the construction of sewers in Jewett street and Sibley alley. Dow W. Harter, clerk of council.

Alliance, O.—The city council has ordered the construction of sanitary sewer No. 117 in North Union avenue. E. P. Speidel, mayor.

Bucyrus, O.—The city council has authorized the construction of various sewers.

Canton, O.—The city council has authorized the construction of sewer in Gay street. B. F. Faust, clerk.

Cincinnati, O.—The city council has ordered the construction of 12-inch, 15-inch and 18-inch vitrified pipe sewers in Waverly avenue and Blaine road. Edwin Henderson, clerk.

Cleveland, O.—The city council has authorized construction work on the Ontario street and Warren road sewers. Director of public service.

Columbus, O.—The city council has voted the construction of sewers in Cole street and in certain alleys.

East Liverpool, O.—The city council has authorized the construction of sewers in McKinnon street, Daisy alley, May street and Dover alley. C. V. Beatty, director of public works.

Findlay, O.—The city council has voted to proceed with the construction of sewers in sub-district No. 5 in district No. 2, $14,153.56. J. C. Edie, clerk.

Hamilton, O.—The council has authorized sewer work in Ludlow, Sycamore and Seventh streets. Director of public service.

Lorain, O.—The council has authorized the construction of sewers. Director of public service.

Mansfield, O.—The city council has authorized the construction of various sanitary sewers. K. P. Kroll, clerk of the council.

Massillon, O.—The city council has authorized the construction of sewers in Wooster street.

Pleasant Ridge, O.—The city has voted $20,000 bonds for the construction of a sanitary sewer system.

Salem, O.—The city council has authorized the construction of sewer in Prospect street. Jas. A. Probert, clerk.

Sebring, O.—The village council has ordered the construction of sewers in California street, Tennessee avenue, New York avenue, Eighteenth street and Twenty-first street. Harry Jenkins, village clerk.

Tiffin, O.—The city council has authorized the construction of sewer in McCollum street. J. Norton Bour, clerk.

Toledo, O.—The city council has voted to construct local sewer No. 1121. John M. Babcock, clerk of council.

Youngstown, O.—The city council has authorized the construction of sewers in West avenue, Albert street and Bernard street.

Zanesville, O.—The city council has authorized the construction of sanitary sewer in Echo avenue. Neil Starkey, clerk of the council.

Oklahoma City, Okla.—The commissioners have voted to establish four new sewer districts.

Tulsa, Okla.—The city commissioners have ordered the constructing of sewers in blocks 1, 8 and 9, Crosbie Heights. E. B. Cline, city clerk.

Tulsa, Okla.—The city has voted $291,000 bonds for the construction of water works, sewers, fire department, street improvements, etc. E. B. Cline, city clerk.

Eugene, Ore.—The city council has ordered the construction of sewers to cost $12,000.

Springfield, Ore.—The city council has ordered the construction of three main sewers, about $12,000.

Canonsburg, Pa.—The town council has voted to construct certain sewers. W. C. Black, secretary of the council.

Chambersburg, Pa.—The town council has authorized the construction of sewers and a sewage disposal plant.

Grove City, Pa.—The council has voted to construct a sanitary sewer in Barmore avenue and Stewart streets. L. L. McKay, borough clerk.

Harrisburg, Pa.—Samuel G. Dixon, commissioner of health, has approved plans for sewer systems in Renovo, Middletown, Throop, Lebanon and Danville.

Harrisburg, Pa.—The city council has authorized the construction of sewers in Fulton street.

Ingram, Pa.—The town council has authorized the construction of sewers in Woodbine and Stratford avenues. D. H. Hainer, secretary.

McKees Rocks, Pa.—The commissioners have authorized the construction of certain sewers.

Monaca, Pa.—The town council has authorized construction of sewers. E. B. Steiner, borough secretary.

Monessen, Pa.—The city contemplates reconstructing and extending the sewers to form a comprehensive system. J. E. Pittman, borough clerk. Alexander Potter, New Yor Citky, consulting engineer.

Pittsburgh, Pa.—The city has authorized the construction of a relief sewer in the Negley Run drainage basin; also sewers in Bates and Russell streets.

Pittsburgh, Pa.—The city council has authorized the construction of sewers in Hazelwood avenue and in Tank alley.

Portage, Pa.—The town council has authorized the construction of a general system of public sewerage. Albert G. Groke, secretary.

Verona, Pa.—The town council has voted to construct sewers in South avenue. Borough engineer.

Washington, Pa.—The town council has authorized the construction of 1,180 feet of sanitary sewer. J. F. Curran, president council.

Wilkes Barre, Pa.—The town council has ordered the construction of a 24-inch stormwater sewer. D. J. Edwards, borough secretary.

Wilkinsburg, Pa.—The borough council has authorized the construction of a sewer or culvert to enclose Nine Mile run. Borough engineers.

Bryan, Tex.—The city has voted $20,000 bonds to complete the water, light and sewer system.

Dallas, Tex.—The city commission has ordered the construction of the Lafayette line and certain storm sewers. City engineer.

Salt Lake, Utah.—The city council contemplates building an outlet sewer canal.

Kennewick, Wash.—The city council has ordered the construction of a sewer system.

Kent, Wash.—The city has ordered the construction of sewers.

Seattle, Wash.—The city council has authorized the construction of sewers in Dexter avenue, etc.; $10,000. City engineer.

Vancouver, Wash.—The city has voted $100,000 for the construction of sewers.

Thermopolis, Wyo.—The city has voted bonds for $20,000 for sewer system. J. B. Chessington, city engineer.

Chilliwack, B. C.—The American consul-general at Vancouver reports that the city contemplates the construction of a concrete pipe building plant and a sewer system.

Bridgeport, Ont.—The city has voted $8,000 bonds to complete the Bowen road sewer.

Pernambuco, Brazil.—The American consul reports that the city is installing a system of sanitary drainage.

WATER WORKS.

BIDS REQUESTED.

Dorris, Cal.—September 4. Constructing water works system.

Fresno, Cal.—September 4, 2 p. m. Constructing steel water tanks at Fresno County Orphanage. D. M. Bramwell, clerk board of supervisors.

Sawtelle, Cal.—September 7. Constructing a water-softening plant at the National Soldiers' Home. E. W. Moore, treasurer.

Canton, Ill.—September 16. Furnishing 2,000,000-gallon pumping engine and air compressor. C. R. Beam, city engineer.

Belle Plaine, Ia.—September 11. Constructing 6 miles of 4-inch to 8-inch water mains. S. H. Ferree, city clerk; Charles P. Chase, Clinton, Ia., engineer.

Decorah, Ia.—September 6. Constructing extension of water mains. F. M. Hughes, city clerk.

Burden, Kas.—September 5, 7 p. m. Constructing a water works system. Rollins & Westover, Kansas City, Mo., engineers.

Mound City, Kas.—Constructing improvements to the water works system; $25,000. P. T. Thorne, city clerk.

Battle Creek, Mich.—Constructing filter plant, capacity from 4,000,000 to 8,000,000 gallons per 24 hours. P. M. Metcalf, engineer.

Rush City, Minn.—September 5. Furnishing and installing electric fire pump and motor, fire mains, pipe, hydrants, etc. Village recorder.

Clarksdale, Miss.—September 5, 8 p. m. Constructing 59,000 feet of cast iron water mains, pumps, artesian well, compressor, etc.; also sewer system. Certified check. M. W. Purnell, city clerk; W. S. Bobo, engineer.

St. Charles, Mo.—Constructing two reservoirs and a pipe line; $30,000. City clerk.

Manhattan, Mont.—September 4, 7:30 p. m. Constructing gravity system of water supply. R. H. Dean, town clerk.

Crawford, Neb.—September 2. Furnishing 34,000 feet of wood stave water pipe, 2,000 pounds of cast iron fittings, etc. Clyde Hornby, city clerk.

Omaha, Neb.—September 6. Constructing 14-inch water main in California street; $8,000. Water board.

Grand Forks, N. D.—September 15. Furnishing 15,000,000-gallon steam pump. H. G. Lykken, city engineer.

Muskogee, Okla.—September 5. Furnishing pumping machinery for water works plant. Chas. Wheeler, Jr., city clerk.

Muskogee, Okla.—September 5, 10 a. m. Constructing a 6,000,000-gallon water purifying and softening plant; the concrete basins only at this time. Alexander Potter, 114 Liberty street, New York, consulting engineer.

Homestead, Pa.—September 4. Laying water pipes, setting fire plugs, etc. Frank Trautman, borough clerk.

Sioux City, S. D.—September 15. Sinking a new well; $12,000. S. B. Howe, city engineer.

Ft. Worth, Tex.—September 5. Constructing a dam containing about 300,000 cu. yds. of earthwork and 60,000 cu. yds. of masonry; also 6½ miles of concrete pipe. Board of engineers.

Colonial Beach, Va.—October 11. Constructing water works and sewer system. Harry Stevens, Union Trust bldg., Washington, D. C., consulting engineer.

Northfolk, W. Va.—October 1. Constructing water system, including concrete tanks and filters. City clerk.

Sparta, Wis.—September 2, 2 p. m. Constructing 4,700 feet of water main, etc. C. H. Gregory, secretary water commission.

West Milwaukee, Wis.—September 5. Constructng 5,000 lineal feet of cast iron water mains, etc. S. Brew, village clerk.

Winnipeg, Man.—September 5, 11 a. m. Supplying cast iron water pipe, f. o. b. city yards. M. Peterson, secretary board of control.

Windsor, Ont.—September 12. Constructing intake pipe and screen well. Water office, Windsor; Smith, Hinchman & Crylls, Detroit, Mich., engineers.

Montreal, Que.—October 3. Constructing filter plant, contract No. 3. L. N. Senecal, secretary board of commissioners.

Brisbane, Australia.—January 30, 12 m. Constructing Mt. Crosby pumping plant, 6,000,000 gallons capacity. Geo. Johnston, secretary metropolitan water and sewerage board.

CONTRACTS AWARDED.

Mena, Ark.—Constructing water works, to the Tonkawa Construction Company, Tonkawa, Okla., $38,000.

Maricopa, Cal.—Constructing 8-inch water pipe from Guyama Valley, 40 miles, to French Bros., Taft, Cal.

San Francisco, Cal.—Constructing 500,000-gallon steel tank, to Frederick C. Roberts & Co., $12,350.

San Francisco, Cal.—Constructing division wall of Twin Peaks reservoir, to Healy-Tibbitts Construction Co., $19,500.

Brighton, Colo.—Laying extensions to water mains, 9,000 feet, to Peter O'Brien, Denver.

Olathe, Colo.—Constructing water works, to Barnes & Stephens, Colorado Springs, $57,300.

Pueblo, Colo.—Constructing 50,000,000-gallon filter plant, to the Roberts Filter Co., Darby, Pa., $251,800.

Americus, Ga.—Constructing reinforced concrete reservoir, to A. J. Wardrep, Nashville, Tenn., $4,782.

Douglasville, Ga.—Constructing water works to J. B. McCrary & Co., Atlanta, $8,100.

Macon, Ga.—Laying 13,506 feet of pipe, with hydrants, etc., to J. B. McCrary & Co., Atlanta, Ga., $14,096.

Bloomington, Ill.—Constructing East Lawn water main system, to Frank Sullivan, Bloomington, $8,302.46.

Chicago, Ill.—Laying water pipes in various streets, to Malachy Murphy, 5315 Wabash avenue; Simon Ryan, 2927 West Congress street; Edward Connor and Carmine Roberts.

Flora, Ill.—Constructing water works, to the H. H. Hall Construction Co., St. Louis, Mo., $44,012.

Herrin, Ill.—Constructing municipal water works to the P. H. Hall Construction Co., East St. Lous, Ill., $42,072.

Pana, Ill.—Constructing water works system, to O. T. Dunlap, Edwardsville, Ill., and

the Platte Iron Works, Dayton, O., $51,200.

Council Bluffs, Ia.—Furnishing 350 tons of cast iron pipe and special castings, to the United States Cast Iron & Foundry Co., Chicago; installing water works extensions, to the Ludlow Valve Manufacturing Co., Troy, New York.

Gilmore City, Ia.—Constructing a water works plant, to C. W. Roland Co., Des Moines, Ia., $13,595.

Wall Lake, Ia.—Constructing water works, to the Des Moines Bridge & Iron Works, Des Moines, Ia., $4,750.

Williams, Ia.—Erecting steel water tank and tower, to the Des Moines Bridge & Iron Co., Des Moines, Ia.

Lynn, Mass.—Constructing dam at Breed's Pond, to E. F. Dwelley, Lynn, $40,649.

Flint, Mich.—Constructing filter plant, to the Pittsburgh Filter Manufacturing Co., $138,895.

Ada, Minn.—Digging 10-inch artesian well, to Swenson Artesian Well Co., Minneapolis, Minn.

Duluth, Minn.—Laying water and gas main, to E. A. Dahl, $16,694.

Duluth, Minn.—Laying water mains, to S. Johnson and Erick, Nordquist & Co., $15,283.20.

Easton, Minn.—Constructing 75,000-gallon steel water tank, to Des Moines Bridge & Iron Works, Des Moines, Ia., $5,690.

Eveleth, Minn.—Supplying 36 tons of 7-inch cast iron pipe and 3 valve boxes, to Jas. B. Clow & Sons, Minneapolis, Minn.

Fairmount, Minn.—Constructing water mains and sewers, to J. W. Turner & Co., $13,000.

Mankato, Minn.—Installing the East Mankato auxiliary water plant, including 50,000-gallon steel tank, 110-foot steel tower, pipe lines, pump house, pump and motor, to J. G. Robertson, St. Paul, $6,850.

Hannibal, Mo.—The city has purchased the water works plant of the Hannial Water Cbo., $275,000.

Milan, Mo.—Constructing water works system, to the Meyers Construction Co., St. Louis, Mo., $21,781.

Culbertson, Mont.—Constructing water works system, to the American Light and Water Co., Kansas City, Mo., $6,940.

Anselmo, Neb.—Constructing water works, to C. G. Empfield, Anselmo, $7,450.

Brainard, Neb.—Constructing water works system and electric light plant, to the Almo Engine & Supply Co., Omaha, Neb., $10,713.

Glen Ridge, N. J.—The borough council has authorized the purchase of the Orange Water Co. plant at $40,000.

pal water works, to Loftus, Tucker & Hall,

Farmington, N. M.—Constructing munici-Farmington, N. M.; and furnishing machinery, to Hendrie & Bolthoff Supply Co., Denver, Colo. Total cost, about $50,000.

Bremen, O.—Constructing complete water works plant, to Rosser & McCroba, Wheeling, W. Va., $43,541.

Columbus, O.—Laying water mains, to the U. S. Construction Co., Columbus, $18,000; West Side mains, $8,950.

Boley, Okla.—Constructing a water works system, to F. R. Stone, Lima, O., $30,000.

Hollis, Okla.—Constructing water works, to Kennedy & Fleming, Oklahoma City.

Oklahoma City, Okla.—Constructing concrete dam at the water plant, to Reinhart & Donovan, Oklahoma City, Okla., $9,339.

Waynoka, Okla.—Constructing water and electric light system, to the Oklahoma Engineering Co., Anadarka, $24,475.

Toledo, Ore.—Constructing water system, 6 miles of pipe, to Jacobson-Bade Co., Portland, Ore., $20,000.

Falls Creek, Pa.—Constructing borough water system, to John and Henry Minns, Dubois, Pa.

Pittsburgh, Pa.—Constructing 20-inch water main, to Booth & Flinn, Pittsburgh, $7,210.25.

Pittsburgh, Pa.—Constructing reservoir for the H. J. Heinz Co. plant, to the Cummings Structural Concrete Co., McKees Rocks, Pa., $30,000.

Aiken, S. C.—Constructing water mains, to Guild & Co., Chattanooga, Tenn., $13,098.

Ipswich, S. D.—Constructing water works and fire hall, to Robinson & Few, Brookings, S. D., $20,000.

Onida, S. D.—Constructing water works, to the Des Moines Bridge & Iron Co., Des Moines, Ia.

Alvin, Tex.—Constructing complete water works system, to Randell, Lovegrove & Wyman, Houston, Tex.

Chillicothe, Tex.—Engineering and constructing a water works system, to O'Neil Engineering Co., Dallas, Tex.

Dallas, Tex.—Sinking five new wells, to Sharpe & Co., Dallas, and Faucett & Hall, Corsicana; supplying 400 tons of 6-inch water pipe, to United States Cast Iron Pipe & Foundry Co.

Lubbock, Tex.—Constructing complete water and sewer system, to E. L. Dalton and Eugene Campbell, Dallas.

Newton, Utah.—Constructing water works system, to the Wheelwright Construction Co., Ogden, Utah., $20,000.

Christiansburg, Va.—Constructing a water works system, to Wm. R. Reynolds, Chicago, Ill., $34,000.

Ft. Ethan Allen, Vt.—Constructing pump house, reservoir and pumping machinery, etc., to L. B. Jacobs, Newark, N. J., $18,396.

Rice Lake, Wis.—Constructing water works extension, about 8,700 feet of pipe, to Hays & Co., Minneapolis, Minn.

Cowley, Wyo.—Constructing water works system, to G. Jaeger, Rich Hill, Mo.

Burnaby, B. C.—The construction of water works mains has been awarded to a Vancouver firm, $154,379. The names of successful bidders and other particulars may be obtained from the Bureau of Manufactures, Washington, D. C.

Port Arthur, Ont.—Constructing reservoir dam at Current River park, to Seaman & Penniman, Port Arthur, $31,755.

Toronto, Ont.—Laying 3,000 feet riveted steel pipe, 6-foot diameter, to Roger Miller & Son, Toronto, $259,900.

CONTEMPLATED WORK.

Fayette, Ala.—The city has voted $22,000 bonds for constructing water works and sewers.

Jackson, Ala.—The city has voted $15,000 bonds for the construction of stand pipe, water mains and fire plugs.

Porterville, Cal.—The city has voted $45,000 bonds for extending water works and $15,000 for paving.

Boulder, Colo.—The city has voted $125,000 bonds for water works improvements, including the Albion dam and new construction at Silver Lake.

Washington, D. C.—The American consular service reports that the city of Salisbury, South Africa, has authorized a $600,000 loan for the construction of water works and electric light plant.

Americus, Ga.—Bonds have been issued for the construction of a reinforced concrete reservoir, $105,000.

Downey, Idaho.—Mr. S. D. Clinton requests information in regard to the purchase of wood stave pipe, metal flumes, headgates, etc.

Pana, Ill.—Bonds have been voted for new machinery for water works.

Arthur, Ia.—Bonds have been voted for the construction of a water works plant.

Belle Plaine, Ia.—The city has voted bonds for the digging of a deep well and the construction of a sewer system.

Goin, Ia.—The city has voteed bonds for the construction of water works.

Hamilton, Ia.—The city has voted $20,000 bonds for the construction of water works.

Prairieburg, Ia.—Bonds have been voted for the construction of a water works system.

Englewood, Kas.—The city has sold $20,000 bonds for the construction of water works and electric light plant.

Pittsburg, Kas.—The city has voted to buy the water works.

Syracuse, Kas.—The city has voted $30,000 bonds for the construction of water works.

Kentwood, La.—The city has voted $550,000 bonds for the construction of water works and sewer system. G. F. Conan, Brookhaven, Miss., engineer.

Frederick, Md.—The city has voted $30,000 for the construction of water works.

Billerica, Mass.—The city has voted bonds for $28,000 to extend water mains on Boston and Concord roads.

Muskegon, Mich.—The city has voted $300,000 bonds for water works improvements.

Stanton, Mich.—The city has voted $10,000 bonds for the construction of municipal electric light plant and water works.

Courtland, Minn.—The city has voted $3,000 bonds for the construction of a water works plant.

Duluth, Minn.—The board of public works has been authorized to construct two 15,000-gallon tanks at Gary.

Greenfield, Mo.—The city has voted to construct water works.

Bellevue, Neb.—The city has voted $20,000 bonds for construction and maintenance of artesian wells.

Tecumseh, Neb.—The city has voted bonds for the extension of its water service; $15,000.

Omaha, Neb.—The city has voted bonds for $8,250,000 with which to buy the water works.

Upland, Neb.—The city has voted bonds to construct a water works plant.

Las Cruces, N. M.—The city has sold $75,000 bonds for the construction of water works and sewers.

Hawthorne, N. J.—The city has voted to construct water works. John A. Shea, borough clerk.

St. Johnville, N. Y.—The village board has voted to extend sewers and water mains in William street and Failing avenue.

Charlotte, N. C.—The water commissioners will purchase at once 9 miles of 24-inch water pipe. Gilbert C. White, Durham, N. C., engineer.

Cincinnati, O.—The city council has ordered the removal and re-erection of the Western Hills tanks, at a cost of not to exceed $80,000. Edwin Henderson, clerk.

Cincinnati, O.—The city council has authorized the laying of water mains to supply Madisonville; $23,000. Director of public service.

Cleveland, O.—The city council has authorized the construction of a West Side tunnel extension for the water department; $700,000. R. Y. McCray, city clerk.

Cleveland, O.—The city council has authorized the construction of a bath house in Edgewater Park; $15,000.

Magnolia, O.—The village has voted to construct water works.

Bennington, Okla.—The town has voted $20,000 bonds for the construction of water works.

Grove, Okla.—The city has sold bonds for the construction of a water works and electris light plant.

Hollis, Okla.—The city has voted $50,000 for the construction of water works.

Norman, Okla.—The city has voted $12,500 bonds for water works improvements.

Oklahoma City, Okla.—The city commissioners are making plans for an extensive new water works plant.

Pawhuska, Okla.—The city has voted $60,000 bonds for extending the water works and electric light plant.

Tulsa, Okla.—The city has voted $291,000 bonds for the construction of water works, sewers, fire department, street improvements, etc. E. B. Cline, city clerk.

Salem, Ore.—The state fair board has appropriated $10,000 for enlarging and extending water mains.

Pittsburgh, Pa.—The city council has authorized a $60,000 contract for a steel rising main from the Mission street pumping station; also for a turbine centrifugal pump at the Ross pumping station; also for coal and ashes handling apparatus at the Aspinwall pumping station.

Hecla, S. D.—The city has voted $8,000 for the construction of water works.

Vermillion, S. D.—The city has voted $32,500 bonds for the purchase and improvement of water works plant. Missouri Valley Engineering Co., Mitchell, S. D., engineers.

Bryan, Tex.—The city has voted $20,000 bonds to complete the water, light and sewer system.

Dallas, Tex.—The city has undertaken the construction of a reinforced concrete dam across Trinity river; $20,000. J. M. Preston, city engineer.

Dallas, Tex.—The city contemplates building water works and sewers.

Greenville, Tex.—The city has issued $35,000 bonds in addition to the $50,000 already issued for improving the water works system.

Henrietta, Tex.—The city has voted $18,000 for a dam across Little Wichita river, to form water supply lake, and a pumping station.

Ladonia, Tex.—City contemplates spending $10,000 for water works system.

Mission, Tex.—The city has voted $15,000 for the construction of water works system.

Ephraim, Utah.—The city has voted $24,000 bonds for water works. P. C. Anderson, city clerk.

Perry, Utah.—The city has voted $10,000 for the construction of water works.

Santaquin, Utah.—The city has voted bonds for the construction of water works.

Harrisburg, Va.—The city has voted $50,000 bonds for filtration plant, fire engine and school buildings.

Tenino, Wash.—The council has granted a franchise to the Tenino Light, Water and Power Co.

Grafton, W. Va.—The city council has provided for improvement of the water works system; $90,000.

Fall Creek, Wis.—The village has voted $10,000 bonds for water works.

Cardston, Alta.—The city has voted $40,000 for water works system. R. E. MacArthur, Lethbridge, Alta., engineer.

Lytton, B. C.—The American consular service reports that construction of water supply and fire system is contemplated.

Point Grey, B. C.—The city has voted $501,260 bonds for extensions and additional equipment for the water system.

Vancouver, B. C.—The American consular service reports that extensive improvements are to be made to the water system.

Mexico City.—The government has appropriated an additional $500,000 for pipe line and distributing system to bring water from Xochimilco.

BRIDGES.

BIDS REQUESTED.

Colusa, Cal.—September 5, 3 p. m. Constructing three spans of concrete bridge across the Maxwell-Colusa road. County supervisors.

Salinas, Cal.—September 6, 2 p. m. Constructing bridge and jetties, $38,000. T. P. Joy, county clerk.

Washington, D. C.—December 19, 3 p. m. Constructing a large bridge over the St. Lucia river at Montevideo, Uruguay. Bureau of Manufactures, No. 7123.

Tampa, Fa.—Sentember 6. Constructing Lafayette street bridge, concrete steel. Board of public works.

Pocatello, Idaho.—September 12. Constructing steel bridge over Bear river at McGregor's ford. County commissioners.

New Athens, Ill.—September 2, 10 a. m. Constructing reinforced concrete bridge. D. M. Fullmer, town clerk.

Decatur, Ind.—September 5. Constructing bridge on Wilshire road. H. S. Michaud, county auditor.

Laporte, Ind.—September 7, 10 a. m. Constructing bridge over Kankakee river on the county line; also concrete arch in New Durham township. F. A. Housheer, auditor Laporte county.

Lebanon, Ind.—September 4, 1 p. m. Constructing and repairing four county bridges. B. F. Herdrich, auditor Boone county.

Petersburg, Ind.—September 5, 2 p. m. Constructing 8 county bridges. John D. Gray, auditor Pike county.

Rockville, Ind.—September 5, 1:30 p. m. Repairing certain bridges. J. E. Elder, auditor Parke county.

Rockville, Ind.—September 16. Constructing a 20-foot reinforced concrete bridge Brown ford. J. E. Elder, auditor Parke county.

Kansas City, Kas.—September 11, 10 a. m. Reconstructing James street bridge over Kansas river. Frank M. Holcomb, county clerk.

Wanilla, Miss.—September 4, 2 p. m. Constructing steel bridge over Fair river on Rockport road. W. H. Speight, clerk.

Kingston, N. Y.—September 5, 11 a. m. Constructing 2 reinforced concrete arch bridges and 4 reinforced concrete girder bridges. Chas. Strauss, president board of water supply, 165 Broadway, New York City.

Fort Chester, N. Y.—September 11. Widening a masonry bridge over Byram river. Board of supervisors, Westchester county.

Wentworth, N. C.—September 6. Repairing Sepples bridge and constructing various other bridges. J. P. McMichael, clerk commissioners of Rockingham county.

Akron O.—September 6, 11 a. m. Constructing Wooster avenue bridge over Wolf creek at Barberton. Certified check $300. Charles L. Wirth, clerk county commissioners.

Cincinnati, O.—September 8, 12 m. Building culverts, bridges and retaining walls on the Clough Creek pike. Fred Dreihs, clerk county commissioners.

Lancaster, O.—September 11, 10:30 a. m. Constructing Ewing and Walnut creek bridges. Certified check, 10 per cent. Palmer Howard, county auditor.

Norwalk, O.—September 5, 10:30 a. m. Constructing Penfield and Perrin bridges, reinforced concrete. Certified check, $100 with each bid. Jay E. Smith, county auditor.

Warren, O.—September 11, 1 p. m. Constructing bridge superstructure in Park avenue, Hubbard. Certified check, $200. W. R. Harrington, clerk county commissioners.

Youngstown, O.—September 2, 11 a. m. Constructing 255-foot steel bridge over the Y. & S. R. R. on Dewey avenue. Certified check, $500. Will B. Jones, county auditor.

Greensburg, Pa.—September 6, 11 a. m. Constructing reinforced concrete bridge over Sewickley creek at Shoup's station. Certified check, 10 per cent. John D. Hitchman, controller Westmoreland county.

North Braddock, Pa.—September 5, 12 m. Constructing steel bridge and stairway over the P. R. R. at 13th street. C. A. Stewart, borough engineer.

Topton, Pa.—Constructing a reinforced concrete bridge over Toad creek. Certified check, 10 per cent. County commissioners; A. L. Rhoads, county controller.

Angleton, Tex.—September 11, 12 m. Constructing two bridges over Brazos river. J. W. Munson, county judge.

Angleton, Tex.—September 11, 12 m. Constructing wooden bridge with draw across the Chocolate river near Liverpool. Certified check, $200. M. L. Drake, Alvin, Tex., county commissioner.

Lamarque, Tex.—September 1, 4 p. m. Constructing several small bridges. E. N. Sanctuary, Galveston, engineer.

Everett, Wash.—September 11. Constructing steel bridge over Sultan river. County engineer.

Vancover, B. C., Can.—September 15. Furnishing material for suspension bridges. J. F. Griffith, public works engineer, Victoria, B. C. E. McBride, road superintendent, Vancouver.

CONTRACTS AWARDED.

Flagstaff, Ariz.—Constructing bridge across Little Colorado river, to Midland Bridge Co., Kansas City, Mo., $84,000.

Camden, Ark.—Constructing a steel bridge over the Outchita river, to the Vincennes Bridge Co., Vincennes, Ind., $41,965.

Little Rock, Ark.—Constructing concrete bridge over Swaggerty branch, to Charles Turkis.

Modesto, Cal.—Constructing 4 bridges, to the Pacific Construction Co., San Francisco, $63,262.

San Lucas, Cal.—Constructing reinforced concrete bridge over San Inez river, to Charles W. Deacon, San Luis Obispo, Cal., $33,825.

Ventura, Cal.—Constructing bridge at Santa Paula, to the Mervy-Elwell Construction Co., Oakland, Cal., $7,940; bridge at Mupu, to Charles W. Corvaley, Los Angeles, $9,568; protection work on both bridges, to Petterson & Schmidt, $12,800.

Boise, Ida.—Constructing 10 steel and concrete bridges in Ada county, to the Missouri Valley Bridge & Iron Co., Leavenworth, Kas., $19,000.

Caldwell, Idaho.—Constructing steel and concrete bridges, to J. H. Forbes & Co.: At New Plymouth, $15,875; at Fruitland, $15,795; at Letha, $15,950.

Chicago, Ill.—Constructing the Washington street bridge: Substructure, to The Fitzsimon & Connell Dredge & Dock Co.; superstructure, to the Strobel Construction Co. Total cost, $237,000.

Dixon, Ill.—Constructing 150-foot steel and concrete bridge across Green river, moving and re-erecting a 60-foot bridge and constructing a 24-foot reinforced concrete bridge, to John Devine, Dixon, Ill.

Elk Grove, Ill.—Constructing one concrete arch bridge and one reinforced concrete truss bridge, to H. S. Wetherell, Elk Grove.

Metropolis, Ill.—Constructing two reinforced concrete bridges, to J. L. Cox, Murphysboro, Ill., $5,300.

Watseka, Ill.—Constructing reinforced concrete bridge across Sugar creek, to Joseph Klein, Freeburg, Ill., $7,890.

Indianapolis, Ind.—Constructing bridge over Eagle creek at Washington street, to the Reliable Construction Co., Indianapolis, $22,466.

Mishawaka, Ind.—Constructing reinforced concrete bridge over St. Joseph river, to C. S. Copp, South Bend, Ind., $64,350.

Washington, Ind.—Constructing bridges, to the Vincennes Bridge Co., Vincennes, Ind., and to James F. Hopkins, Montgomery, Ind.

Iowa Falls, Ia.—Constructing steel and concrete bridge over the Iowa river, to the Lana Construction Co., Harlan, Ia.

Newton, Ia.—Constructing 4 bridges, to H. H. Northcott, Hesston, Ia., $5,137.

Louisville, Ky.—Constructing bridge over Salt river at West Point, to Capitol Construction Co., Columbus, O., $56,300.

Shreveport, La.—Constructing substructure of bridge across Red river between Shreveport and Bossier, to Peter McGee, Kansas City, Mo., $78,692.

Bangor, Me.—Constructing Bangor-Brewer bridge to Boston Bridge Co., $47,800.

Sharpstown, Ind.—Constructing concrete bridge over the Nanticoke river, to the Roanoke Bridge Co., Roanoke, Va., $52,229.65.

Pembroke, Mass.—Constructing reinforced concrete bridge over Pudding creek, to Powers Bros., Brockton, Mass.

Moorhead, Minn.—Constructing 2 bridges at Oakport and Uien, to the Hopeman Construction Co.

New Ulm, Minn.—Constructing steel bridge across the Big Cottonwood river, to the Security Bridge Co., Minneapolis, Minn., $6,975.

St. Louis, Mo.—Constructing third section of the municipal bridge, to the Missouri Valley Bridge & Iron Co., Leavenworth, Kas., $52,097; fourth section, to the American Bridge Co., New York City, $427,297.

Beatrice, Neb.—Repairing Court street bridge, to Standard Bridge Co., Omaha, $2,162; concrete bridge on South Sixth street, $588.

Belvidere, N. J.—Constructing steel and concrete bridge over Pequest creek, to P. A. Hennessy, Mt. Vernon, N. Y., $7,450.

Plainfield, N. J.—Constructing a reinforced concrete bridge over Green Brook at Washington avenue, to the Ferro Concrete Co., Harrisburg, Pa., $8,390.

Abany, N. Y.—Constructing lift bridge over Lock 1, Oswego canal at Bridge street, Phoenix, to Lupper & Remick, Buffalo, $13,238.

Lowville, N. Y.—Constructing a concrete arch culvert over Mill creek, to John Fitzgerald, Sacket Harbor, N. Y., $8,777.

Massena, N. Y.—Constructing concrete-steel arch bridge, to Pratt & Phillips, Watertown, N. Y., $27,625.

Warsaw, N. Y.—Constructing steel bridge, to the Warsaw, Wilkinson Company, $2,795.

Fargo, N. D.—Constructing metal culverts in Cass county, to the North Dakota Metal Culvert Co., Fargo.

Cincinnati, Ohio—Constructing substructure Gilbert avenue viaduct, to Cranford Construction Co., Cincinnati, $50,160; superstructure of reinforced concrete, to Kaps-Brehme Co., Cininnati, $144,999.

Hamilton, O.—Constructing canal bridge, to Al S. Fox, Dayton, $7,562.

Pomeroy, O.—Constructing bridge across Leading creek, to the Capitol Construction Co., Toledo, Ohio.

Spiro, Okla.—Constructing 250-foot steel span highway bridge, to the Missouri Valley Bridge and Iron Works Co., Leavenworth, Kan. S. L. Brock, superintendent.

Norristown, Pa.—Constructing stone arch bridge over Park Run, to J. M. Smith, Perkeomen, Pa.

Pittsburg, Pa.—Constructing steel work on Union bridge, to American Bridge Co., $297,792; concrete span of Atherton avenue bridge, to O. M. Driver, $91,379.54.

Pittsburg, Pa.—Constructing the Allegheny Beaver county bridge over Sewickley creek, to the Capitol Construction Co., Columbus, O.

Pittsburg, Pa.—Constructing masonry of the steel bridge over the Monongahela river near New Geneva, to McMinamim & Sims, Arcade Bldg., Philadelphia.

Stowe, Allegheny County, Pa.—Constructing concrete foundations for foot bridge over P. & L. E. R. R. from Island avenue to Nichol avenue, to Frank Bryan.

Williamsport, Pa.—Constructing ten-span steel bridge over the Susquehanna river, to the Massillion Bridge and Structural Irion Co., Massillion, Ohio, $33,000; and substructure to the Leonard Engineering Co., New York, $9,370.

Memphis, Tenn.—Construction of subways in Rayburn boulevard and Mississippi avenue, to F. D. Harvey & Co., Memphis, $50,000.

Fort Worth, Tex.—Constructing two steel bridges, with concrete piers, etc., to Austin Bros., Dallas, Tex., $14,800.

Houston, Tex.—Constructing Main street viaduct, to the Carmichael Co., St. Louis.

Richmond, Tex.—Constructing two steel bridges across the Brazos river, at Thompson and Orchard, to the Missouri Valley Bridge Co., Leavenworth, Kan., $48,500.

Roanoke, Va.—Constructing bridge over Roanoke river at Eighth avenue, to Roanoke Bridge Co., $32,300.

Fairchild, Wis.—Constructing steel and concrete bridge, to William Meyers, Mondovi, Wis.

Hudson, Wis.—Constructing steel-span bridge across Lake St. Croix, to the Central States Bridge Co., Indianapolis, Ind., $29,000.

Edmundton, Alta.—Constructing piers and abutments for the steel bridge over the Saskatchewan river, to Cannell & Spencer, Edmundton; for steel work, to the Dominion Bridge Co., Montreal.

Victoria, B. C.—Constructing a suspension bridge at Churn creek, to C. Gardiner Johnson & Co., Vancouver.

Ottawa, Ont.—Constructing steel and concrete bridge over the Rideau river, to Mr. Cameron, Cumberland, Ont., $40,000.

CONTEMPLATED WORK.

Pasadena, Cal.—The city contemplates building a $200,000 bridge across Arroyo Seco.

Hartford, Conn.—Bids will soon be asked by the board of contract and supply for constructing a steel girder bridge, $5,000. R. W. Clark, city engineer.

Wabash, Ind.—The county commissioners have appropriated $30,000 for constructing a bridge over the Wabash river at Huntington street. J. P. Noftzger, auditor Wabash county.

Shreveport, La.—$100,000 bonds have been voted to build steel buildings for the Louisiana State Fair.

Fitchburg, Mass.—The city council has ordered the readvertisement of the Fifth street viaduct contract

Mankato, Minn.—The county commissioners contemplate the repair of various bridges.

Beatrice, Neb.—The county supervisors have ordered the reconstruction of the steel wagon bridge over Blue river at Iron Mountain. Practically every bridge along Bear creek for eight miles was destroyed by the recent floods.

Bethlehem, N. Y.—The assembly has passed a bill appropriating $100,000 for the construction of a boulevard and viaduct from Albany to Bethlehem.

Fulton, N. Y.—The city and state authorities have authorized the construction of the Broadway bridge.

Barberton, Ohio—The county contemplates building a bridge over Wolf creek on Wooster avenue, $6,000.

Cleveland, O.—The city council has authorized the improving and repairing of Central viaduct, $250,000, and the construction of the Praha S. E. bridge, $15,000. R. Y. McCray, city clerk.

Klamath Falls, Ore.—The county contemplates building a new bridge over Klamath river on the Ashland road.

Pittsburg, Pa.—The city council has authorized the construction of the Atherton avenue bridge, $100,000.

Reading, Pa.—The county commissioners have authorized the construction of the Penn street bridge.

Providence, R. I.—The board of park commissioners has selected plans for a bridge at South Park, to cost about $20,000. Corbett & Higgins, architects.

Sioux Falls, S. D.—The city commissioners have ordered the construction of a $40,000-bridge over the Big Sioux river at Eighth street. Starke Bridge Co., Des Moines, Ia., engineers.

Rogersville, Tenn.—The county commissioners have authorized the construction of a bridge over Holstein river, $20,000.

Cotulla, Tex.—The county commissioners have authorized the building of a bridge

over the Nueces river at Ernest Lake crossing.

Centralia, Wash.—The city will build a concrete bridge across Main street ditch by day labor, $1,200.

Lachine, Que.—The Federal Parliament has voted $80,000 for the construction of a bascule bridge over the Lachine Canal, department of engineers.

STREET LIGHTING.

BIDS REQUESTED.

Jacksonville, Fla.—Sept. 4, 3 p. m. Constructing municipal power station building; also removing and re-erecting two condensing equipments; also removing and re-erecting two 1,500 kw. turbo generators. Certified check with each bid. W. M. Bostick, Jr., chairman board of bond trustees.

Jacksonville, Fla.—Sept. 4, 3 p. m. Furnishing and erecting switchboard, lightning arresters, and sub-station switchboard for the municipal electric plant. Certified check, $1,000. W. M. Bostwick, Jr., chairman board of bond trustees.

St. Paul, Minn.—Sept. 7. Furnishing 4,100 gas lamp heads, 1,400 gasoline lamp heads, and 1,400 posts; also maintenance of these lamps. Oscar Claussen, commissioner of pubic works.

Oneida, N. Y.—Sept. 15. Lighting streets and public places for one, three and five years. Albert Morris, chairman board public works.

Lima, O.—Sept. 15, 12 m. Furnishing boilers, engines, generators, etc., for municipal power station. George E. Whitney, secretary commission.

Honea Path, S. C.—Sept. 1.—Constructing water works and electric light plant, $37,000. John F. Monroe, chairman board of public works.

CONTRACTS AWARDED.

New Britain, Conn.—Constructing extension to the subway in Arch street, to the Safety Insulation Wire and Cable Co., New York City, $20,070.

Washington, D. C.—Constructing power plant at the Mare Island Navy Yard, Cal., to John W. Danforth & Co., Buffalo, N. Y., $104,420.

Boise, Ida.—Furnishing electric light to the city for seven years, to the Idaho-Oregon Light and Power Co., $126,000.

Quincy, Ill.—Installing 118 ornamental lamp standards, to the J. W. Turner Construction Co., Des Moines, Ia.

Independence, Ia.—Furnishing new equipment for light and power plant, to the Allis-Chalmers Co., Milwaukee, Wis., $11,000.

Newton, Ia.—Constructing municipal electric light plant, to Eastman & Stines, Newton, $13,700.

Greensburg, Kan.—Constructing power house for the municipal electric lighting system, to J. G. Hewitt.

Shreveport, La.—The city council has authorized a contract with the Shreveport Gas, Electric Light & Power Co., for lighting the streets for six years.

Crisfield, Ind.—Furnishing city lights, to the Crisfield Ice Manufacturing Co., for five years, $1,400 for 100 lights each year.

Escanaba, Mich.—Constructing municipal gas plant, to F. W. Freese, Ft. Wayne, Ind., $25,000.

Browns Valley, Minn.—Constructing electric light plant, to the Minneapolis Steel and Machinery Company, $10,950.

Livingstone, Minn.—A franchise has been granted to the Mineral Point Power and Electric Co., to light the village.

Brainard, Neb.—Constructing electric light plant and water works system, to the Almo Engine & Supply Co., Omaha, $10,713.

Wymore, Neb.—Constructing distributing and street lighting system, to the Columbian Electrical Co., St. Joseph, Mo., $8,303.

Newark, N. J.—Installing electric lights in Union township, to the Public Service Electric Light Co. Ninety lights for one year, $20 each.

Mandan, N. D.—Constructing municipal electric light plant, to G. W. Haggert, Fargo, N. D., $75,000.

Valley City, N. D.—Supplying electric lamps for the city, to Bryan-Marsh Co.

Canal Dover, O.—Furnishing forty street lights, with certain conditions, to Selder & Hayes, $12,000 per year.

Mt. Vernon, O.—Installing feeder wires and yard lights for the Ohio State Sanitorium, to Erner Hopkins Co., Columbus, O., $10,299.

Newark, O.—The plant of the Licking Light and Power Co., has been sold to the American Gas and Electric Co., H. L. Montgomery, Auburn, N. Y., will be general manager.

Waynoka, Okla.—Constructing electric light plant and water plant, to the Oklahoma Engineering Co. Anadarko, Okla., $24,475.

McKeesport, Pa.—Furnishing city lighting for five years, to the Monongahela Light Co., at the rates now paid.

Smithton, Pa.—The city has granted a franchise to the Smithton Light, Heat and Power Co., for city electric lighting.

Wilkes-Barre, Pa.—Lighting lanes and alleys with gas and naptha lights for three years, to the Welsbach Company.

Brookings, S. D.—Furnishing electric lamps, to the Bryan-Marsh Co.; transformers, to the Fort Wayne Electric Works; and wattmeters to the General Electric Company.

Sioux Falls, S. D.—The two electric light and power plants have been purchased and merged into one by H. M. Byllesby & Co.

Ft. Flagler, Wash.—Installing electric lighting system to the W. E. Chase, Eng. Co., Spokane, Wash., $29,000.

Seattle, Wash.—Furnishing electric meters, to Burton R. Stare, $40,928.36.

Tacoma, Wash.—Installing lighting system in the court house, to Caldwell Bros., about $3,000.

Walla Walla, Wash.---Furnishing power and light to the city for ten years, to Pacific Power & Light Co.

McMechen, W. Va.—Street lighting, to the Ohio Valley Electric Co., Benwood, W. Va.

CONTEMPLATED WORK.

Washington, D. C.—The American consular service reports that the city of Salisbury, South Africa, has authorized a $600,000 appropriation for the construction of electric light and water supply plants.

Hazlehurst, Ga.—The city has voted $5,000 bonds in addition to the $30,000 already voted for electric lighting plant.

Mascoutah, Ill.—The city has voted $12,000 bonds for the construction of municipal electric light plant.

Paxton, Ill.—The city has voted $17,000 bonds for the construction of an electric light plant.

Kansas City, Kan.—The city commissioners have approved plans for $650.000 municipal light plant. James Cable, commissioner of water and light.

Independence Ia.—The city council has voted $11,000 for electric light and power plant.

Ness City, Kan.—The city has voted $16,000 for the construction of an electric light plant.

Syracuse, Kan.—The city voted $10,000 for electric light plant.

Stanton, Mich.—The city has voted $10,000 bonds for the construction of municipal light plant and water works.

Minden, Neb.—Bonds have been voted for the construction of a municipal electric light plant, $15,000.

Middleton, O.—The city council has ordered the installation of new electric lights on two streets.

Payne, O.—The town has voted $17,000 bonds for water works, and $9,700 bonds for electric light plant.

Salem, O.—The city council contemplates installing new street light distributing system.

Pawhuska, Okla.—The city has voted $10,000 for improving electric light system.

Eugene, Ore.—The city water board will purchase poles for the city lighting system.

Altoona, Pa.—The Penn Central Light & Power Co., have taken over a number of small electric lighting companies in Cambria county, with the intention of furnishng current from plants at Warrior's Ridge and Altoona.

Fallston, Pa.—The town council has granted a franchise to the Beaver River Fall Co., for electric lighting.

Philadelphia, Pa.—The city is installing many new street lights. James MacLaughlin, chief electrical bureau.

Pittsburg, Pa.—The city council has authorized the installing of additional equipment at the municipal electric light plant on the north side.

Plankinton, S. D.—A franchise for installing an electric light plant has been granted to W. A. Kuntze.

Greenville, Tenn.—The city has voted $25,000 bonds for water works and electric light plant.

Bryan, Tex.—The city has voted $20,000 bonds to complete the water, light and sewer system.

Walla Walla, Wash.—The city clerk will advertise for bids for furnishing electrical power for the arc and cluster lights in the city for five and ten-year periods.

Fond du Lac, Wis.—The city council has voted to install ornamental electric lights in Main street.

Random Lake, Wis.—The city has voted to construct an electric light plant.

Kamloops, B. C.—The American consul-general at Vancouver reports that the city is contemplating the construction of a hydro-electric plant to cost about $200,000.

Hamilton, Ont.—The city has voted $504,000 bonds for the construction of municipal light and power plant.

Port Stanley, Ont.—The city has voted $12,750 for the purchase of an electric light plant and installation of distributing system.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

BIDS REQUESTED.

New York, N. Y.—Sept. 7, 12 m. Furnishing labor and materials for removing snow and ice in the boroughs of Brooklyn, the Bronx, and Manhattan. W. H. Edwards, commissioner of street cleaning.

CONTRACTS AWARDED.

Virginia, Minn.—Constructing 25-ton garbage incinerator, to the Decarie Incinerator Co., Minneapolis, Minn. $23,700

Atlantic City, N. J.—Collecting garbage for five years, to the Atlantic City Product Co., $248,000.

Muskogee, Okla.—Constructing garbage disposal plant, to Lewis & Kitchen, Kansas City, Mo.

CONTEMPLATED WORK.

Bloomington, Ill.—The city council has ordered the advertising of a contract for hauling garbage for one year. Harry E. Rhoads, city clerk.

Toledo, O.—The city council has authorized the sweeping and sprinkling of certain streets. John M. Babcock, clerk of council.

Charleroi, Pa.—The town has voted $65,000 for street improvement, a garbage plant, and a municipal building.

Monongahela, Pa.—The city has voted $10,000 bonds for the construction of a garbage crematory.

FIRE APPARATUS.

BIDS REQUESTED.

New York, N. Y.—Sept. 5, 10:30. Constructing extension of underground fire alarm telegraph system on East End avenue. Fire commissioner.

East Cleveland, O.—Sept. 8. Installing complete combination fire and police signal systems. Certified check, 10 per cent. Kline F. Leet, city clerk.

Seattle, Wash.—Sept. 1, 10 a. m. Furnishing various fire fighting apparatus. Certified check with each bid. C. B. Bagley, secretary board of public works.

Winnipeg, Man.—Sept. 25. Furnishing fire fighting equipment. Chief of fire department, central fire station.

CONTEMPLATED WORK

Stockton, Cal.—The city contemplates buying a motor driven hose wagon and fire engine, and a motor driven hose wagon and chemical engine.

Washington, D. C.—The bureau of manufactures reports a request from a business house in the West Indies for information about fire fighting equipment for four large cities. Bureau of Manufactures, No. 7209.

Honolulu, H. I.—The city and county board of supervisors contemplate the purchase of two auto fire trucks for chemical apparatus, to cost about $6,000 each.

Louisville, Ky.—The board of public works contemplates installing an extensive underground fire alarm system.

Boston, Mass.—The city contemplates the purchase of motor driven fire fighting equipment.

Eveleth, Minn.—The city contemplates the construction of a fire hall.

Minneapolis, Minn.—The city council has ordered the construction of a fire engine house in the Lake Harriet district.

Minneapois, Minn.—The city council has ordered the purchase of two auto trucks for the water department.

Tulsa, Okla.—The city has voted $291,000 bonds for the construction of water works, sewers, fire department, street improvements, etc. E. B. Cline, city clerk.

Braddock, Pa.—The council has authorized the purchase of two automabile chassis for the fire department.

McKees Rocks, Pa.—The commissioners have authorized the purchase of 2,000 feet of fire hose.

Narragansett Pier, R. I.—The town council has voted to purchase a horseless steam fire engine. Howard Caswell, chief.

Harrisonburg, Va.—The town has voted $50,000 bonds for fire engine, water works improvements, etc.

Everett, Wash.—The city contemplates the purchase of a $6,000 chemical auto fire engine, a $9,000-engine and hose auto, and a chemically equipped runabout, also additional fire boxes, etc.

Seattle, Wash.—The city council has authorized the purchase of certain apparatus and supplies for the fire department.